BRIDGE INSPECTION REPORT

COLUMBIA TERMINAL RAILROAD (COLT) BRIDGE
RAIL LINE OVER BUSINESS LOOP 70

AT COLUMBIA, MISSOURI
BOONE COUNTY



11.19.2018

BRIDGE NO. 708B

PREPARED FOR:

CITY OF COLUMBIA

COLUMBIA TERMINAL RAILROAD

NOVEMBER 19, 2018

PREPARED BY:

McCLURE™

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11.19.2018
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DISCLAIMER

This inspection report is based on data and conditions that are generally applicable as of October 2018 and the conclusions and recommendations herein are therefore applicable only to that timeframe. This inspection was completed using standard inspection methods with up-close inspection performed on both the superstructure and visible portions of the substructure units.

1.0 INTRODUCTION

1.1 GENERAL INFORMATION AND SCOPE

The inspection of COLT Bridge 708B was completed by MEC on October 10, 2018. Traffic control was implemented permitting hands-on inspection of the structure using standard bridge inspection techniques. The bridge was inspected by Dane Shaw, P.E., Dustin Berry, P.E., and Aaron McVicker, P.E. Each of these individuals are Nationally Certified Bridge Inspectors (NBIS) and Fracture Critical Steel Certified Inspectors.

This report presents the findings of the inspection, recommendations for repair methods, and good faith engineering cost estimates as well as implications to perform those repairs.

1.2 PROJECT SITE

The project site is located west of Paris Road at GPS coordinates of 38°57'50"N and 92°18'43"W (see Photo 1).



Photo 1 - Bridge Location

1.3 BRIDGE DESCRIPTION

Bridge 708B consists of a fracture critical through girder bridge with an open wood deck supporting the single COLT rail line. The bridge was designed and constructed in 1926. The superstructure is a single span of 46'-0" from CL of bearing to CL of bearing and is on a 40°26' skew. Numbering for the structure starts from south to north with the west

main girder being Girder 1 and the east main girder being Girder 2. The floorbeams are identified as Floorbeams 1 thru 6 from south to north.

The deck structure of the bridge is an open deck configuration with the rails supported by typical rail timbers spanning laterally and supported on stringers with stringers framing to floorbeams and finally to the main girder connections. The two (2) main bridge girders are 66″ deep riveted members supporting six (6) floor beams ranging from 32″ to 36″ in depth and connected with 24″ or 20″ deep stringers.

The bridge is supported on large concrete abutments that are founded on 20′ long treated piles. All reinforcing within the abutments is identified as "rods" and observations during field inspection indicate these to be smooth reinforcing bars.

The stringers are wide flange members and all other members in the structure consist of riveted elements using plate and angles.

The bridge is currently posted at 14′-0″ clearance and is recorded with the Missouri Department of Transportation. Measured vertical clearance at the eastbound gutter was 15′-7″.



Photo 2 - Looking east at COLT Bridge 708B elevation.

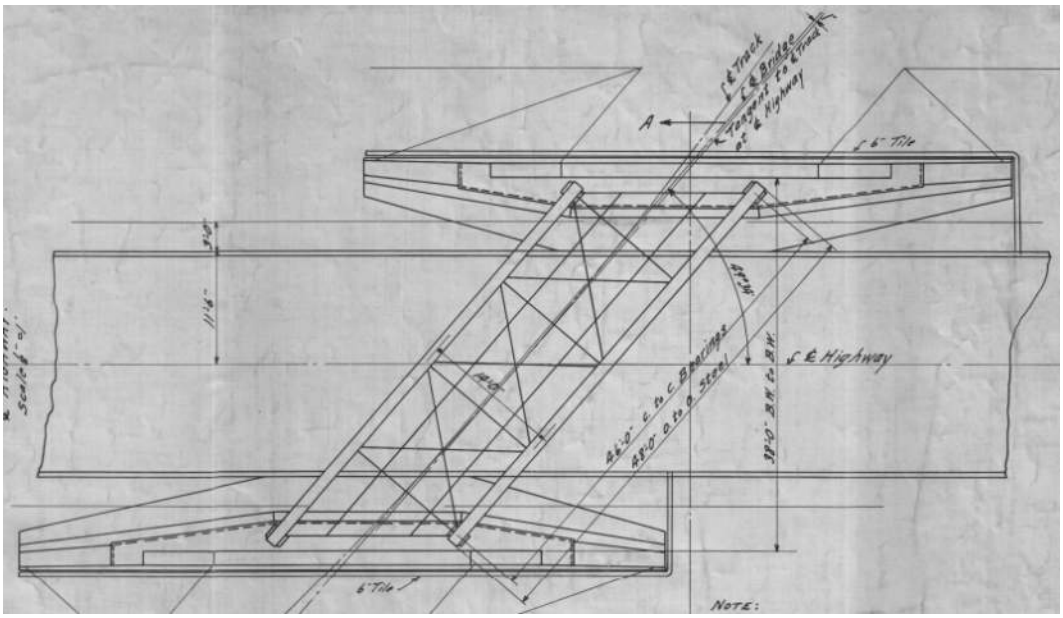


Photo 3 – Bridge 708B Plan

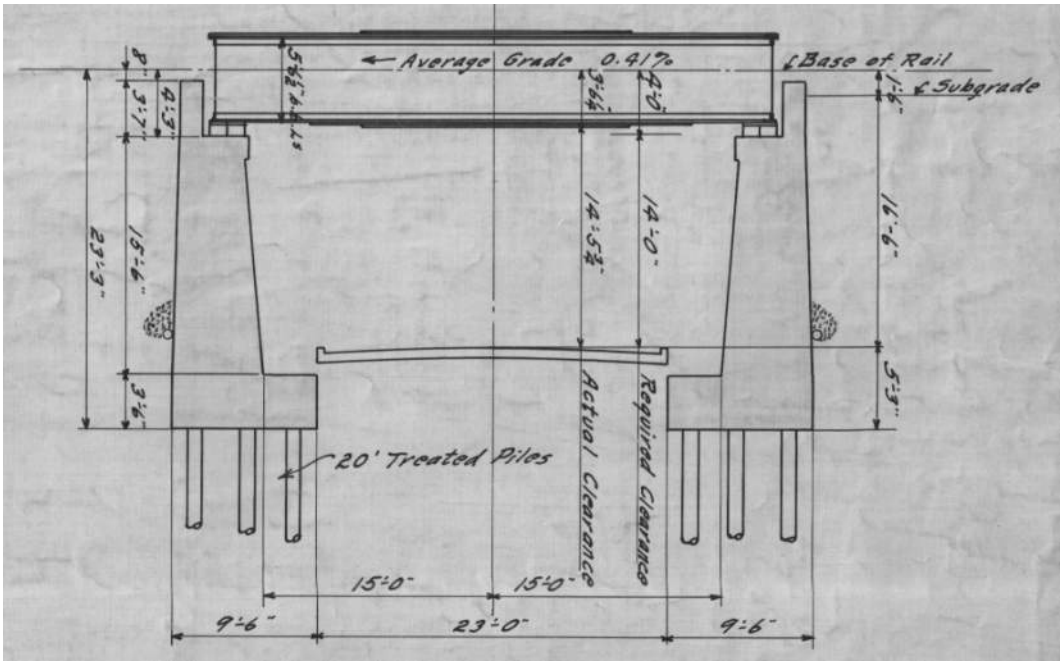


Photo 4 - Bridge 708B Section/Elevation

1.4 EXECUTIVE SUMMARY OF INSPECTION FINDINGS:

The general condition of the bridge superstructure is fair (5). Given the age of the structure, it is apparent that good maintenance practices have allowed the structure to achieve a lifespan of nearing 100 years with minor deterioration of isolated locations of the superstructure. Contrary to the superstructure, deterioration of the substructure is evident and has resulted in a less than desirable appearance to the abutment. Large cracks, spalling concrete, and weeping water were noted throughout both abutments. The general condition of the bridge substructure is considered serious (3).

Table 1 - Main Structural Element Condition Ratings

ELEMENT	RATING	CRITICAL FINDINGS
Bridge Deck	Good (7)	None
Superstructure	Fair (5)*	Damaged/Missing Anchor Bolts
Substructure	Serious (3)	Significant Rotation of North & South Abutments

* Damaged/Missing anchor bolts not reflected in rating as if repaired within 90 days of finding. Bridge is currently non-operational.

Overall, the structure is in fair condition with only minor deterioration of the superstructure noted. Typical cracking, spalling and delaminations were noted throughout the abutments. Rotation of each abutment was noted to varying levels with detailed discussion and documentation included herein.

Given the findings of this inspection, it is McClure's recommendation that this structure be repaired using appropriate construction techniques prior to use of the structure by the Columbia Terminal Railroad (COLT). The structure does not currently pose any danger to the public, however deterioration of the structure is present.

2.0 INSPECTION PERFORMANCE

Structural Inspection of the Bridge 708B was completed by Dane Shaw, P.E., NBIS, Dustin Berry, P.E., NBIS, and Aaron McVicker, P.E., NBIS. Inspection of the bridge was performed using traffic control on Business Loop 70 allowing inspectors to using hands-on techniques with direct access to the superstructure and substructure.

The inspection of Bridge 708B was performed as a special inspection precipitated by a concerned citizen report and is not considered to be a regular scheduled inspection of the bridge.

2.1 INSPECTION TERMINOLOGY:

The following report, while not supplied for NBIS (National Bridge Inspection Standards) submission, follows the terminology and intent of the NBIS program. The table below represents the code and description for condition assessments contained within this report. Use of this approach is recognized by DOT's and AREMA where the rail bridge in question crosses public roadways.

Table 2 - Condition Assessment Terminology (FHWA BRIM)

CODE	DESCRIPTION
N	*NOT APPLICABLE*
9	*EXCELLENT CONDITION*
8	*VERY GOOD CONDITION* – no problems noted
7	*GOOD CONDITION* – some minor problems
6	*SATISFACTORY CONDITION* – structural elements show some minor deterioration.
5	*FAIR CONDITION* – all primary structural elements are sound but may have minor section loss, cracking, spalling, or scour.
4	*POOR CONDITION* – advanced section loss, deterioration, spalling, or scour.
3	*SERIOUS CONDITION* – loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	*CRITICAL CONDITION* – advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	*"IMMINENT" FAILURE CONDITION* – major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic.
0	*FAILED CONDITION* – out of service, beyond corrective action

2.2 PREVIOUS REPAIR DISCUSSION:

In 1944 significant repairs to the abutments were performed as a result of significant cracking in each abutment. These repairs included removal of deteriorated concrete adjacent to the cracks (2 feet to both sides of cracks and 4 inches in depth), pressure injection of the cracks, 3-foot dowels at approx. 45 degrees to crack, and repair shotcrete installation with wire mesh. Original drawings indicating these repairs are provided in Appendix A.

2.3 INSPECTION OBSERVATIONS

The following information reflects the conditions experienced in the field during the inspection of Bridge 708B.

2.3.1 BRIDGE DECK

The bridge deck of Bridge 708B consists of transverse wood ties framing to longitudinal stringers and transverse floorbeams. The deck (ties, rails, and attachments) appear in good and serviceable condition with no significant deterioration of the structure noted (see Photo No. 5).



Photo 5 – Looking south at general bridge deck condition of Bridge 708B

2.3.2 BRIDGE SUPERSTRUCTURE

The bridge superstructure consists of a through girder system of floorbeams and stringers. Original drawings outlining section properties are attached in Appendix A of this report.

The bridge superstructure is in Fair (5) condition overall. Typical of the construction methods and design, there are isolated areas of section loss throughout the bridge. One area of loss is at each of the gusset plates connecting the floorbeams and lateral bracing to the exterior girders (see Photo No. 6). This deterioration is expected for a bridge of this age and results in little to no reduction in overall bridge capacity.

MAIN GIRDERS

The main girders of the bridge are in overall good condition. Minor rusting at the intermediate web stiffeners is evident although section loss in those regions appears minor and limited to light scaling rust.

Impact damage was noted to the bottom flange of the west girder immediately above the eastbound roadway (see Photo No. 7). The damaged region is approximately 3 feet in length and has resulted in an upward localized deflection of the flange approximately 2-1/2 inches. Gouges at this location have resulted in section loss that should be considered when rating the structure. Previous inspection reports consider this loss to be 4%. Due to the location of the damage and limited need for full development of the design moment capacity at that section, the 5% reduction is considered adequate for rating purposes.



Photo 6 - Looking south/southeast at gussetted connection of the east girder and floorbeam 1



Photo 7 - Impact damage to West Girder over eastbound lane

FLOORBEAMS AND STRINGERS

Overall the floorbeams and stringers making up the bridge are in good condition. Again, minor rusting and section loss at tight corners is present but not considered significant.

Damage to Floorbeam 3 was noted and determined to be associated with the impact to the west girder previously noted (See Photo No. 8). This floorbeam was noted to have laterally displaced approximately 3-3/4 inches over a distance of 2 feet near midspan of the floorbeam.

MAIN GIRDER BEARINGS

The bridge bearings at both ends of the bridge are exhibiting significant deterioration and damage. Detailed inspection notes including descriptions of each defect is included in Appendix B of this report. Significant findings include;

1. Failed and missing anchor bolts at the northwest and northeast bearings (see Photo No. 9)
2. Rotated and dislocated anchor bolts at the southwest and southeast bearings (see Photo No. 10)
3. Anchor bolts missing nuts at the southwest and southeast bearings
4. Significant shifting of the bridge at the north bearings (approx. 6-1/2 inches)

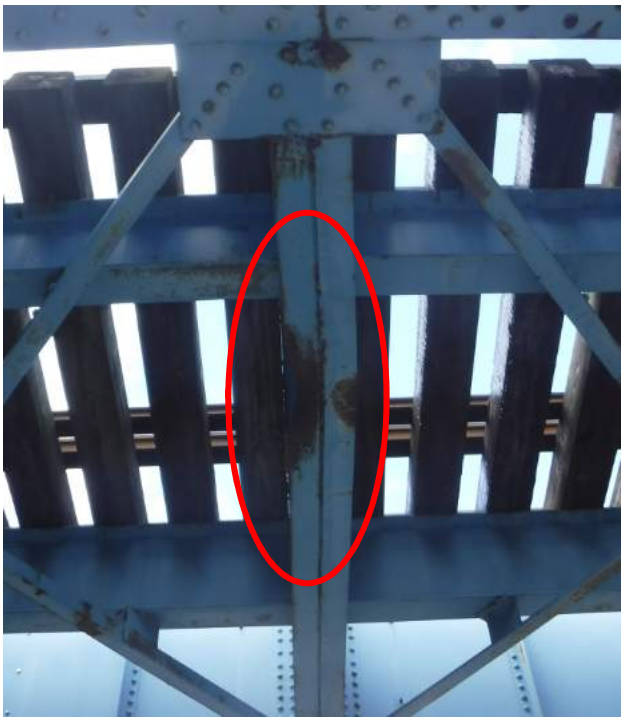


Photo 8 - Damage to Floorbeam 3 over eastbound lane

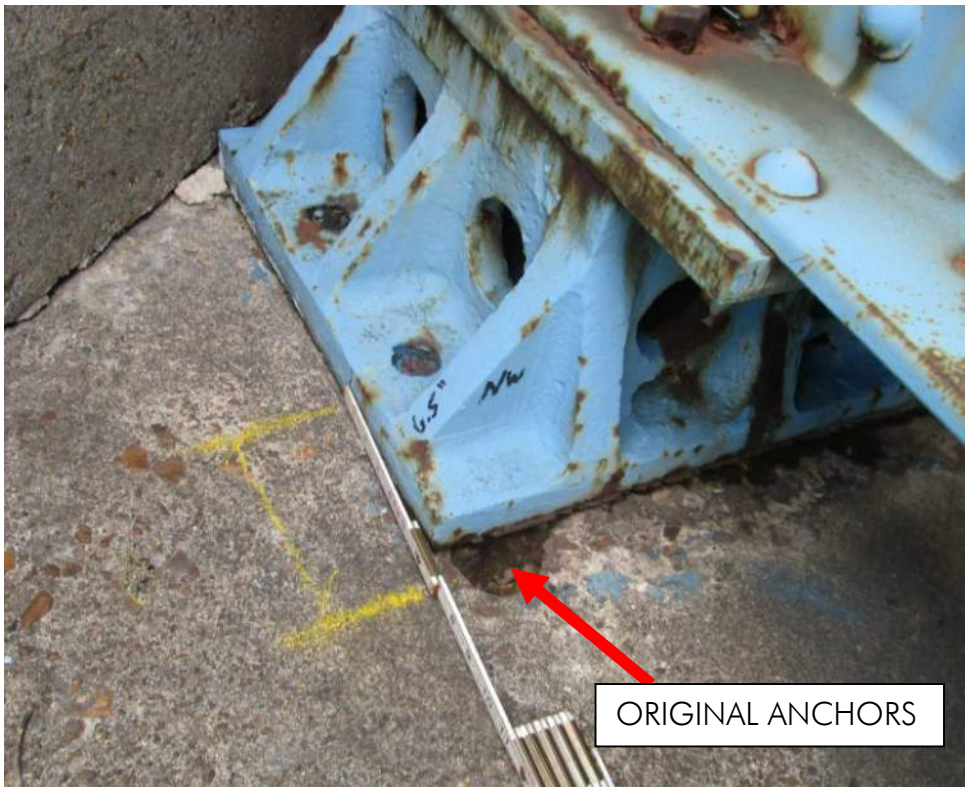


Photo 9 - Missing anchor bolts and shifted position (6.5") of Northwest bearing



Photo 10 - Dislocated anchor bolt of southwest bearing

2.3.3 BRIDGE SUBSTRUCTURE

The substructure units of Bridge 708B consist of two (2) pile founded abutments constructed at a approx. 40-degree skew to the bridge superstructure. Original construction drawings are included in Appendix A of this report.

As discussed in Section 2.2 of this report, repairs to each abutment were performed in 1944 and included pressure injection of concrete cracking with grouted dowels installed at approx. 45-degrees to the crack angle. Wide sections of the abutment (as large as 4-feet and 4 inches in depth) were removed adjacent to these cracks and reinforcing installed. These sections were then patched using shotcrete methods. Details of these repairs are included in Appendix A of this report.

In addition to original documentation, Appendix B of this report contains detailed field notes relating to the current condition of each abutment. Typical widespread conditions include individual narrow to wide cracks with efflorescence, map cracking with efflorescence, spalling, spalling with exposed reinforcing, and concrete delaminations. Each of these noted defects are included in the attached field notes with specific reference to the location and extent.

Most all cracking noted in the field notes represents minor cracks of narrow to wide width. One crack of concern is present in the middle of the north abutment

and runs full height of the abutment as well as through the cap and backwall (see Photo No. 11).



Photo 11 - Wide crack in north abutment, cap in foreground, backwall in background

ABUTMENT ROTATION

Due to displaced bearings and girder contact with backwall, movement of the abutment was investigated. During field inspection, the vertical and horizontal measurements of the abutment were taken at four locations identified below (see Photo No. 12). These measurements are shown in Table 3 and details of measurements included in Appendix B.

Table 3 - Abutment Rotation Measurements

LOCATION	VERT. DIM	HORI. DIM	LATERAL DISPLACEMENT[1]
NW	14′-8″	9-1/4″	7/8″
NE	14′-8″	9″	1-1/8″
SW	14′-8″	6-1/4″	3-7/8″
SE	14′-8″	6-1/4″	3-7/8″
TOTAL LATERAL DISPLACEMENT			4-7/8″ [2]

[1] Lateral displacement calculation assumes rotation about the footing base

[2] Total inward settlement of abutments

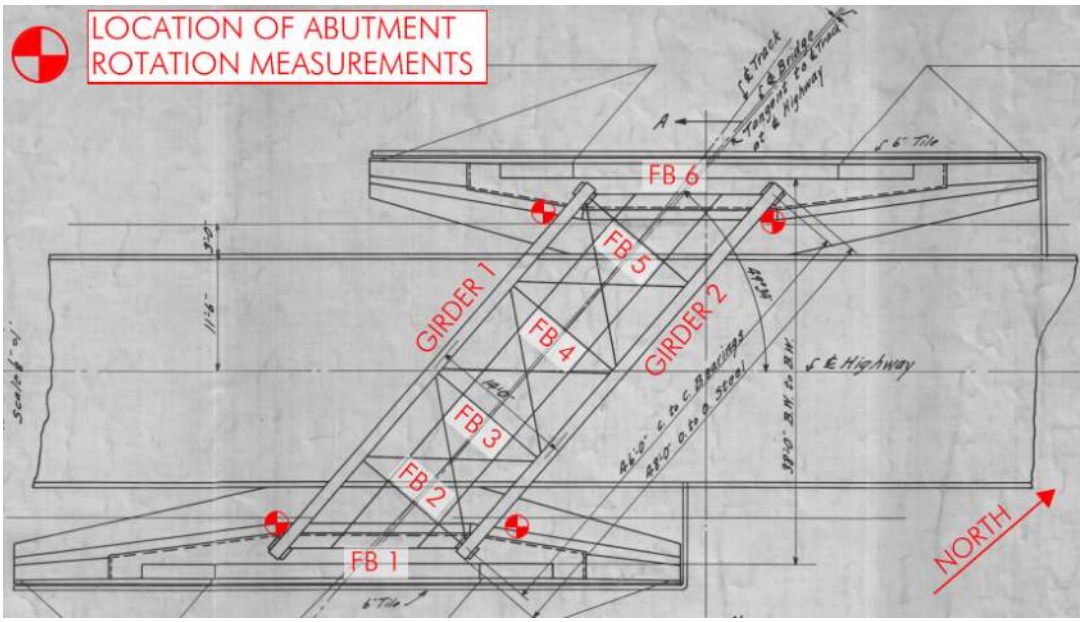


Photo 12 - Abutment rotation measurement locations

The results of field measurements and evaluation suggests each of the abutments are experiencing rotation about their respective bases. Due to pavement and timber piles, sliding is not expected to be a major factor in inward deformation. Field measurements of the northwest bearing indicate approximately 6-1/2 inches of total lateral displacement along the centerline of the structure. The approximate calculated total lateral displacement of the abutments, perpendicular to the abutments, was determined to be 5 inches. The correlation of these measurements indicates probable partial failure of the abutment piling in uplift allowing rotation of the abutments under loading demands.

Other possible causes for wall rotation could include:

1. Excessive buildup of hydrostatic pressure behind wall. This could be due to incorrect grading, changes in grading, or deteriorate drain pipe.
2. Failure or settlement of front row of piles. Piles are in compression resisting overturning and could have long term settlement issues.
3. Strain and/or failure of large unreinforced elements of the abutment.

It is important to note that the rotation measurements correlate well to the measured movement at the north bearings. (i.e. 6-1/2" @ 40-degree skew is approx. 5 inches measured normal to the abutment)

3.0 RECOMMENDATIONS

The following recommendations represent the opinion of McClure Engineering Company based on the inspection performed on October 10, 2018.

3.1 IMMEDIATE RECOMMENDATIONS

Based on the findings of this inspection, no imminent danger exists to the public relating to the bridge. The overall superstructure is determined to be in acceptable condition and the results of the 2013 Load Rating Report acceptable with no further deterioration to be considered. However, the substructure units of the bridge are experiencing on-going rotation about their base.

Currently the superstructure of the bridge is providing a "strut" to help support and restrain further rotation and deterioration of the substructure. Should the anchor bolts at the south end of the structure continue to deteriorate and subsequently fail, the bridge would be free to translate horizontally in all directions. Further rotation of the abutments could rack the superstructure, reducing the effectiveness of the strut effect, resulting in additional rotation and deterioration of the abutments.

While the superstructure is satisfactory, and the substructure would likely support the Cooper E-50 design loads, it is unclear as to the extent of the deterioration of the supporting piles and continued use of the structure is not recommended. Although the superstructure can support the Cooper E-50 design loads, the Cooper E-50 design loads create large live load surcharge pressure on abutment. These additional lateral pressures could contribute to higher rotations. This recommendation is provided for the following reasons:

1. Rotation of the abutments is evident from the field measurements and supports the displacement of the bearings from original installed position as documented.
2. The cause of rotation is unknown and should be monitored. Rotation is possible if pile capacities have been exceeded or damage/deterioration of the piles has taken place.
3. Evaluation of the bridge structure for the affects of the backwall engagement (aka "strut") should be performed to quantify the reduced flexural capacity of the structure due to axial loads.

3.2. REPAIR RECOMMENDATIONS

The following represents specific recommendations as to repair of defects and conditions noted during the inspection of Bridge 708B.

3.2.1 SUPERSTRUCTURE RECOMMENDATIONS

Minor cleaning and painting of the congested and difficult to reach places is recommended to maintain the overall satisfactory condition of the structure. Focus should be given to the gusset connections where pack rust and water pooling has promoted deterioration. These areas should be cleaned using industry standard methods and the bridge coating system should be reapplied.

Monitoring of the impact location on the west girder is recommended to ensure no further deterioration or crack development at the damage site. This damage is noted to be in similar size and condition to the 2013 Inspection Report with no further progression or deterioration.

Consideration should be given to repair of the anchor bolts at the north end of the structure. Given the position of the bridge in relation to the abutments, this may present several challenges. Before installing new anchors, the abutment should be stabilized per the recommendations in Section 3.2.2. Installation of new anchors will lock the bridge into the abutments and may create load scenarios that were responsible for abutment rotation and anchor bolt failure.

3.2.2 SUBSTRUCTURE RECOMMENDATIONS

The substructure of the bridge, aside from the rotation mentioned prior, is in Fair to Poor condition. The cracking, spalling, and delaminated areas noted in the field notes is typical of a bridge over 90 years old. Most of the concrete deterioration is noted to be occurring at the periphery of the repaired material installed in the mid 1940's. Repair of these cracks and spalls can, and should, be completed to prevent further deterioration of the abutments. These repairs should be completed using methods such as pressure injection and grouting.

To remain in service, the abutments should be stabilized from further movement and rotation. In order to stabilize these abutments, geotechnical investigations should be performed to confirm inspection findings and determine geotechnical conditions. A possible repair option includes installation of helical rock anchors along multiple lines to provide sufficient tieback to the fill material behind the abutments. These anchors would be installed to provide resistance to overturning

securing the abutment from further rotation. Installation of this system, or similar, is recommended at both abutments.

A significant crack was noted near the middle of the north abutment (see Photo No. 11). This crack should be repaired using appropriate pressure injection methods after stabilization of the abutments are completed.

4.0 CONCLUSIONS

Inspection of the COLT Bridge 708B over Business Loop 70 resulted in satisfactory superstructure findings suggesting structural capacity of the superstructure to be sufficient and in similar condition to the 2013 load rating.

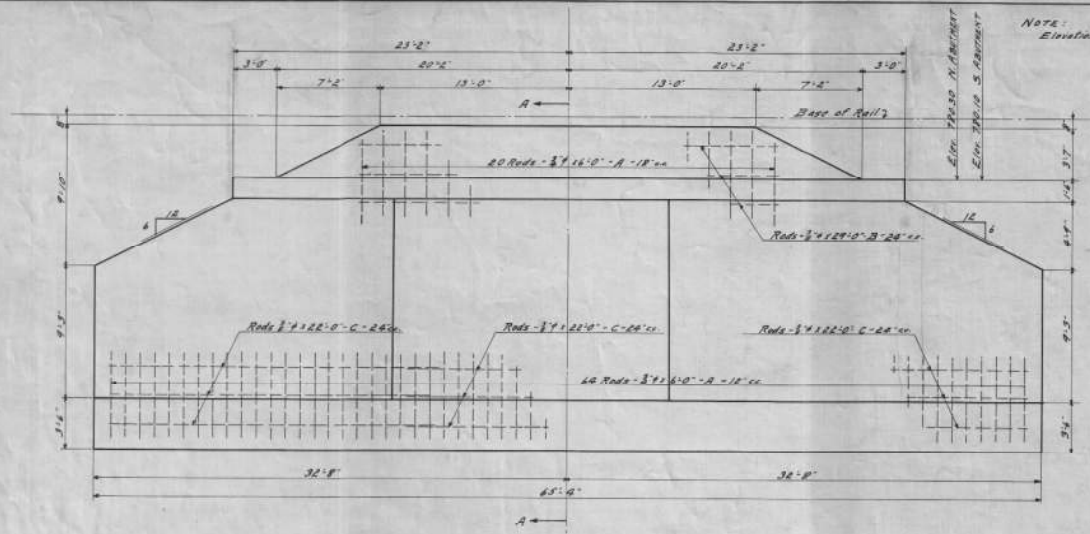
However, during inspection and documentation of the substructure elements, several findings support the recommendation to perform repairs and or close the structure to train traffic.

1. Rotation of both abutments is present and the cause is unknown.
2. Bearings at the north abutment have no positive attachment to the abutment as anchor bolts have sheared and the bridge is displaced approx. 6-1/2".
3. Displacement of the structure has resulted in the west girder bearing on the north abutment backwall with the east girder nearly in contact as well.

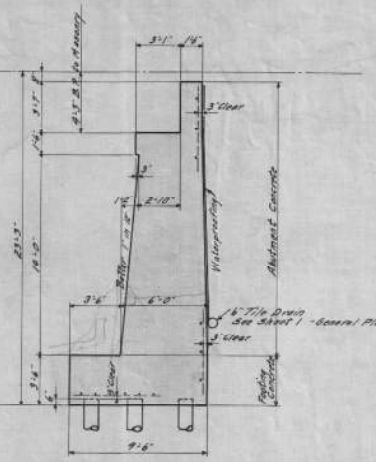
Based on these observations, it is McClure's recommendation that this structure be repaired as recommended in this report before continuing to use the structure as part of the Columbia Terminal Railroad Operations. While none of the noted conditions represent immediate danger to the public, the structure needs stabilization and repair to continue to support the Cooper E-50 design loads.

APPENDIX A

ORIGINAL DESIGN DRAWINGS

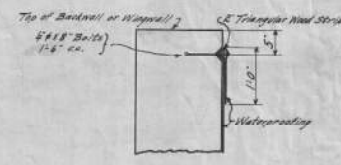


ELEVATION

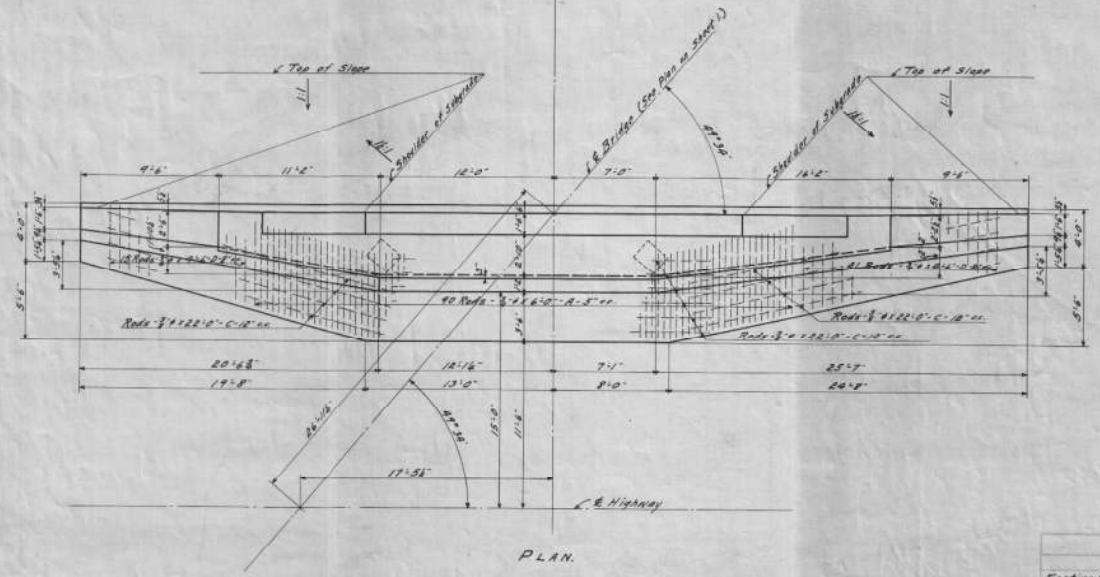


SECTION "AA"

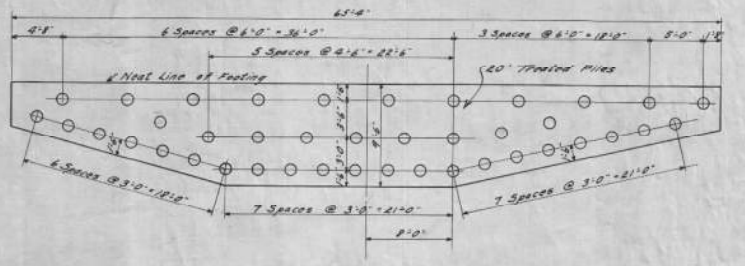
Reinforcing Rods - One Abutment					
Location	No.	Size	Length ft.	in.	Mark
Backwall	20	¾ ϒ	6	0	A
"	3	¾ ϒ	29	0	B
Heel	64	¾ ϒ	6	0	A
"	9	¾ ϒ	22	0	C
Footing	90	¾ ϒ	6	0	A
"	36	¾ ϒ	42	6	D
"	14	¾ ϒ	22	0	C



DETAIL SHOWING METHOD OF HOLDING WATERPROOFING AT TOP.
Scale 1" = 1'



PLAN.



PILE PLAN.
Scale: ⅛" = 1'

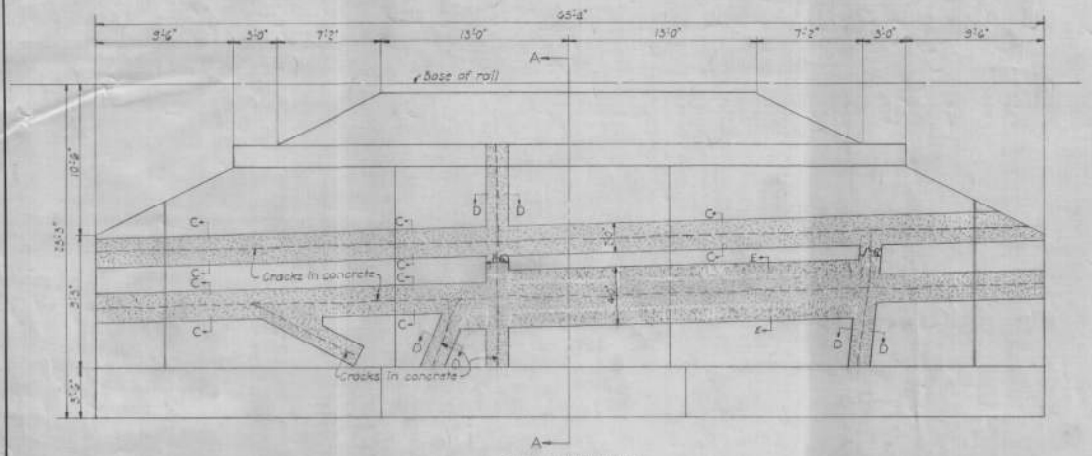
Quantities		
	1-Abutment	2-Abutments
Footing Concrete	66.66 cu.yds.	122.32 cu.yds.
Abutment "	103.07 "	274.18 "
Reinforcing Steel	2055 lbs.	4116 lbs.
Treated Piles	920 lin.ft.	1640 lin.ft.
Waterproofing	880 sq.ft.	1760 sq.ft.

WABASH RAILWAY
MOBERLY DIVISION
ONE MILE NORTH OF
COLUMBIA, MO.
BOONE COUNTY

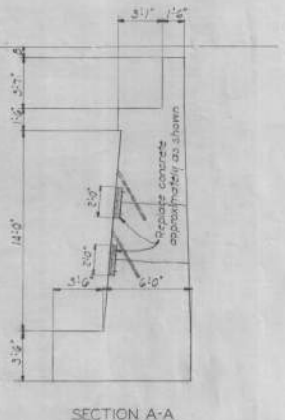
ABUTMENT DETAILS
BRIDGE 708B

OFFICE OF THE CHIEF ENGINEER
SCALE: 1/4"=1'
FEBRUARY 18, 1926.
SHEET (2) OF (4)

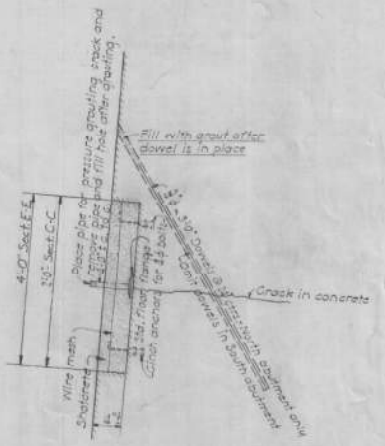
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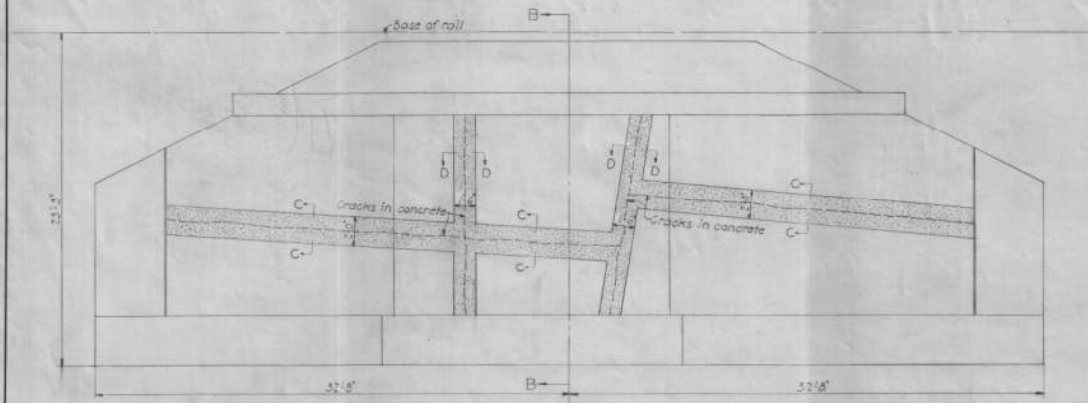
NORTH ABUTMENT



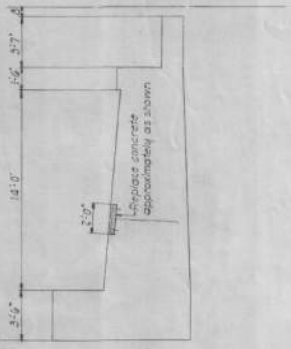
SECTION A-A



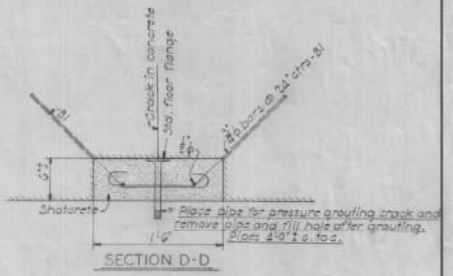
SECTION C-C & E-E



SOUTH ABUTMENT



SECTION B-B

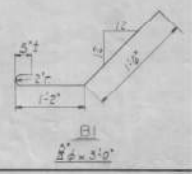


SECTION D-D

WORK TO BE DONE

Repair cracks in abutments by removing old concrete along cracks and placing dowels, anchors, wire mesh and shotcrete as shown.

Pressure grout all cracks.



REINFORCING BARS			
NO.	DIA	LENGTH	REMARKS
2	#8	61'0"	Str.-North Abut.
2	"	64'0"	" " "
2	"	10'-0"	" " "
4	"	13'-0"	" South "
2	"	15'-0"	" North "
66	#8	3'-0"	" " "
48	"	3'-0"	Dent B1-Both "

QUANTITIES			
ITEM	UNIT	EST.	ACT.
Remove concrete	C.Y.	9	
Dowel holes	Ea.	134	
Reinf. steel	Lb.	700	
Shotcrete 4"± thick	Sq.Ft.	450	
Shotcrete 6"± "	" "	70	

A. F. E. NO. _____ DATE COMPLETED _____

WABASH RAILROAD COMPANY
OFFICE OF CHIEF ENGINEER

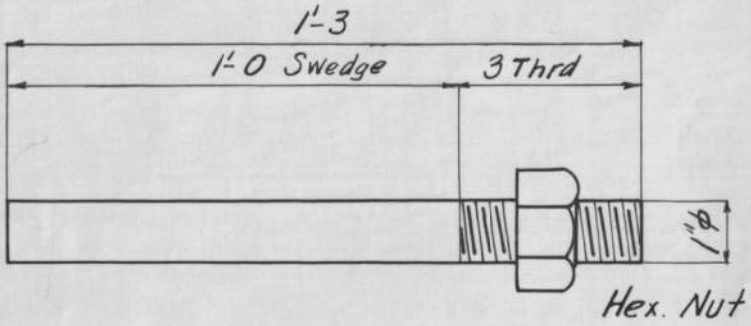
STRUCTURE:	BRIDGE 708B
LOCATION:	COLUMBIA MO
DIVISION:	MOBERLY
SCALE: 1"=1'-0"	
DATE: Mar. 10, 48	ABUTMENT REPAIRS
DRAWN BY: AHS	
CHECKED BY: AHS	
REVISED:	

SHEET NO.	NO. OF SHEETS
1	1

QUANTITIES BY: AHS
CHECKED BY:

SKETCH, SHOP AND SHIPPING BILL

AMERICAN BRIDGE COMPANY



Anchor Bolt-A1

GHS No.	MEMBER NO. PCS.	MEMBER NAME	MEMBER MARK	MATERIAL NO. PCS.	MATERIAL SHAPE	MATERIAL LENGTH FT.	MATERIAL LENGTH INS.	MATERIAL + ING.	REMARKS	CALCULATED WEIGHT	ORDERED NO. PCS.	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM	SHIPMENTS
1	16	Anchor Bolts	A1	16	1"ϕ	1	3			53				5	
2				16	Std Hex Nuts					7				55	
3										60					
4															
5															
6															
7															
8															
9															
10															
11															
12															

RIVETS — HOLES — DATE — NAME

J.O.G 6 17 26
W.W.J 7 12 26
WV 7 21 26

DATE 19

DRAWINGS: Gary #3 — FABRICATION: Gary

STRANG ORDER No. E9164

SHEET No. C 2

Page Total-60#

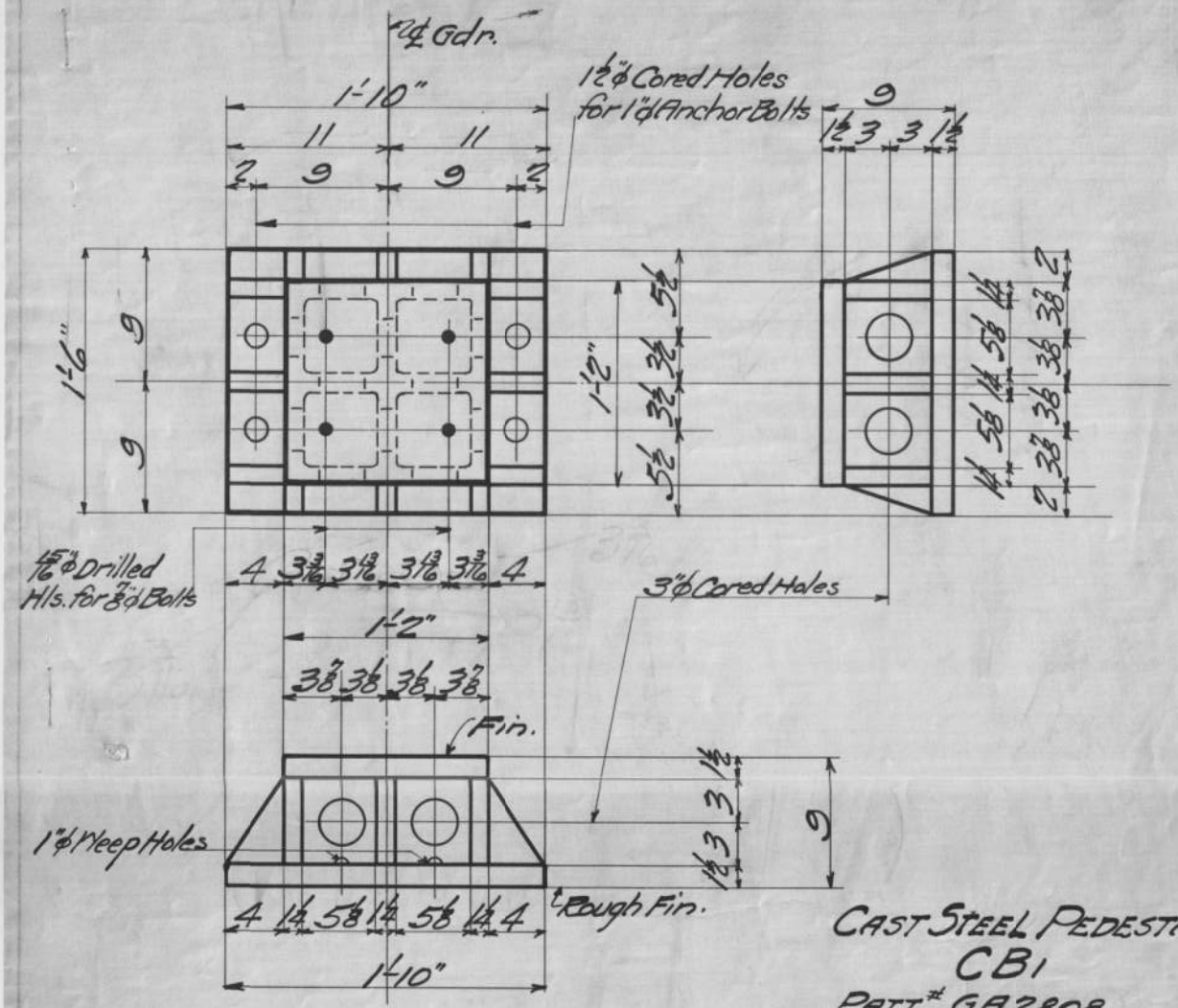
NAME OF STRUCTURE

1-48'-0"-S.T. SKEWED T.P.G. SPAN - WABASH R.R.

708-B

SKETCH, SHOP AND SHIPPING BILL

AMERICAN BRIDGE COMPANY



CAST STEEL PEDESTAL
CB1
PATT.# GA2808
Annealed.

LINE NO.	MEMBER NO. PCS.	MEMBER NAME	MEMBER MARK	MATERIAL NO. PCS.	MATERIAL SHAPE	MATERIAL LENGTH FT.	MATERIAL LENGTH INS.	MATERIAL ½ INS.	REMARKS	CALCULATED WEIGHT FOR THIS MEMBER	ORDERED NO. PCS.	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM	SHIPMENTS
1	4	Pedestals CB1		4	18 x 9	1	10		C.S. Patt.# GA2808	466				61-9318	

Page Total-1,864#

PAINT: One Coat Detroit Graph. Co's. #2400 Ready Mixed Red Lead
Fin. Surfaces-One Coat White Lead & Tallow

WORKS	HOLES	DATE	DRAWINGS FABRICATION	ORDER No.	SHEET No.
		W.J. 6 3 26	Gory 3	Strong	
		O.B. 6 4 26	Gory	E9164	C1
		WAV 6-15 26			

NAME OF STRUCTURE

1-48'0" S.T. SKEWED T.P.G. SPAN — WABASH R.R. 708-B

FIELD RIVETS AND BOLTS

AMERICAN BRIDGE COMPANY

LINE NO.	NO. PCS.	DIAM.	RIVETS		BOLTS: LENGTH UNDER HEAD	BOLTS: HEAD	BOLTS: NUT	BOLTS: WASHER	BOLTS: TYPE OF BOLT	GRIP	Act. No	REMARKS	CALCULATED WEIGHT TOTAL	SHIPMENTS
1	15	7/8			5 1/4	Hex	Hex.	None	Plain	4	12		22	
2	6	7/8			5 1/2					4 3/8	4		9	
3													31	
4														
5														
6	120	7/8	2 1/4							3/4	105		74	
7	115		2 3/8							7/8	100		74	
8	75		2 1/2							1	50		49	
9	12		2 5/8							1 1/8	6		8	
10	80		2 7/8							1 3/8	60		56	
11	145		3 1/8							1 1/2	126		110	
12	27		3 1/4							1 5/8	18		21	
13	105		3 1/2							1 3/4	84		86	
14	70		3 3/4							2	56		60	
15	36		4							2 1/4	24		32	
16	50		4 1/4							2 1/2	32		47	
17	4		4 5/8							2 7/8	2		4	
18													621	
19														
20														
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43														
44														
45														
46														

FIELD RIVETS AND BOLTS

Page Total:- 652#

NAME	DATE
WMJ	7 17 26
J.S.B.	7 21 26
RMP	7-23-26

DATE / 191

DRAWINGS Gary #3

FABRICATION Gary

Strang

ORDER No. E9164

PAGE No. C3

NAME OF STRUCTURE

WABASH RY. BR. #708-B MOBERLY DIV. 1-48'-0" S.T.T.P. GDR SPAN. 708-B

ERECTORS LIST
FIELD RIVETS AND BOLTS

AMERICAN BRIDGE COMPANY

LINE NO.	NO. PCS.	DIAM.	RIVETS		BOLTS: LENGTH UNDER HEAD	HEAD	NUT	WASHER	TYPE OF BOLT	GRIP	THICKNESS OF MATERIAL CONNECTED	LOCATION
1	12	7/8			5 1/4	Hex	Hex	None	Plain	4	5/8 7/8 1/2	G1 & G2 to Cstg's.
2	4	7/8			5 1/2	"	"	"	"	4 3/8	3/8 5/8 7/8 1/2	G1 & G2 to Cstg's. at P8
3												
4												
5												
6	20	7/8	4							2 1/4	1/2 5/8 5/8 1/2	FB1 to G1 & G2 (x end)
7	20	"	4 1/2							2 1/2	1/2 1/2 1/2 1/2 1/2	" " Conn. Pls " "
8	34	"	3 1/2							1 1/2	5/8 3/8 1/2	" " G1 & G2 opp. end
9	22	"	3 1/2							1 3/4	3/8 1/2 1/2 3/8	FB2 " " " opp. end
10	4	"	4							2 1/4	1/2 1/2 5/8 5/8	" " " " x end
11	18	"	3 1/2							1 3/4	1/2 5/8 5/8	" " " " " "
12	2	"	3 3/4							2	3/8 5/8 3/8 5/8	ocl to Gdrs. of FB2 opp. end
13	18	"	2 3/8							1 3/8	3/8 5/8 3/8	" " " " " " "
14	2	"	3 3/4							2	3/8 5/8 3/8 5/8	ocl to Gdrs. at x end FB3
15	18	"	2 3/8							1 3/8	3/8 5/8 3/8	-- -- " " " "
16	44	"	3 1/2							1 3/4	3/8 1/2 1/2 3/8	FB3 to G1 & G2
17	20	"	3 3/4							2	3/8 5/8 3/8 5/8	ocl to " " " at opp end FB3
18	48	"	2 3/8							7/8	1/2 3/8	FB2 & FB3 to Lat'l. Pls
19	8	"	4 1/4							2 1/16	1/2 3/8 5/8 1/2 1/16	" " " " " " on G1 & G2
20	26	"	3 3/4							1 15/16	3/8 5/8 1/2 1/16	Lat'l. Pls to G1 & G2
21	4	"	3 3/8							1 1/2	3/8 5/8 1/2	" " " " " "
22	12	"	2 3/8							7/8	3/8 1/2	FB1 to Brkt's.
23	40	"	2 3/8							7/8	3/8 1/2	FB2 & FB3 to Brkt's.
24	10	"	3 1/4							1 5/8	3/8 5/8 5/8	Brkt. 1 to G1 & G2
25	8	"	3 1/4							1 5/8	3/8 5/8 5/8	Brkt. 2 to G1 & G2
26	36	"	2 1/4							3/4	3/8 3/8	Brkt 3. to G1 & G2
27	2	"	4 5/8							2 7/8	3/8 5/8 1 1/8	Lat'l. Pls. P3 to G1 & G2
28	48	"	2 1/4							3/4	3/8 3/8	L1, L2, & L3 to P1, P2, & P3
29	21	"	2 1/4							3/4	3/8 3/8	Lat'l. Conns. at ctr.
30	24	"	2 5/8							1 5/16	7/16 7/8	" " to Strgs.
31	40	"	2 1/2							1	1/2 1/2	S2, & S3 to FB1
32	88	"	3 1/8							1 1/2	1/2 1/2 1/2	S1, S2, & S3 to FB1, FB2, & FB3
33	8	"	2 1/2							1	1/2 1/2	S1 to FB2
34	4		3 3/4							2	1/2 3/8 5/8 1/2	FB2 & FB3 to Lat. Pls on G1 & G2
35	2		2 1/2							1	3/8 5/8	Lat Pls to G1 & G2
36	2		3 3/4							2	3/8 3/8 5/8 5/8	Brkt 2 to G1 & G2
37	6		2 5/8							1 1/8	3/8 3/8 3/8	Brkt 3 to G1 & G2
38												
39												
40												
41												
42												
43												
44												
45												
46												

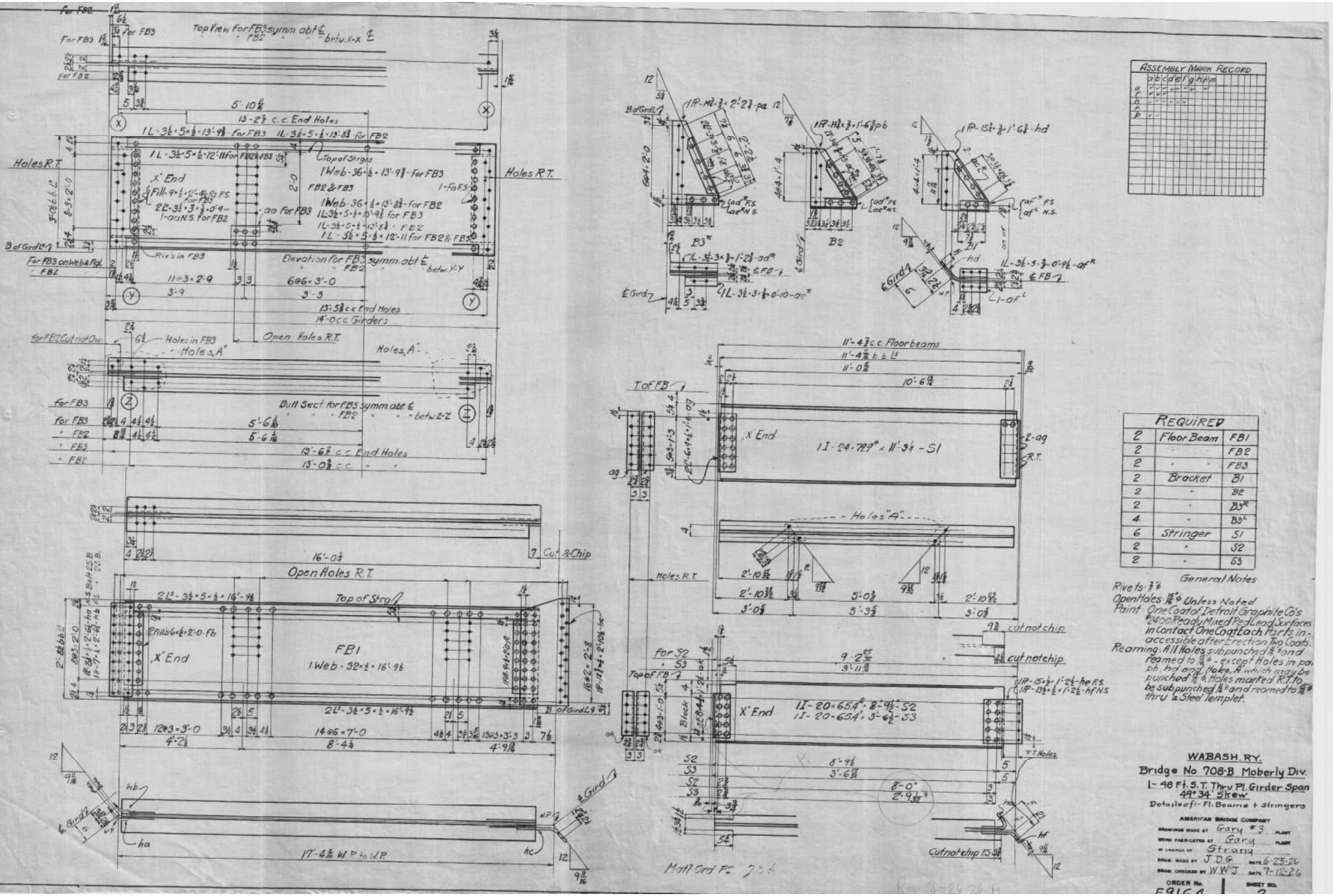
708 B

FIELD RIVETS AND BOLTS

DATE / NAME								DATE	DRAWINGS	ORDER No.	SHEET No.
[illegible]	7	17	26					1 19	Gary 3	Strang	EF 1
[illegible]	7	21	26						FABRICATION Gary	E9164	

NAME OF STRUCTURE

WABASH RY. BRIDGE # 708-B MOBERLY DIV. 1-48'-0" S.T.T.P. GDR. SPAN.



ASSEMBLY MARK RECORD

	a	b	c	d	e	f	g	h	k	m
a										
c										
h										
e										

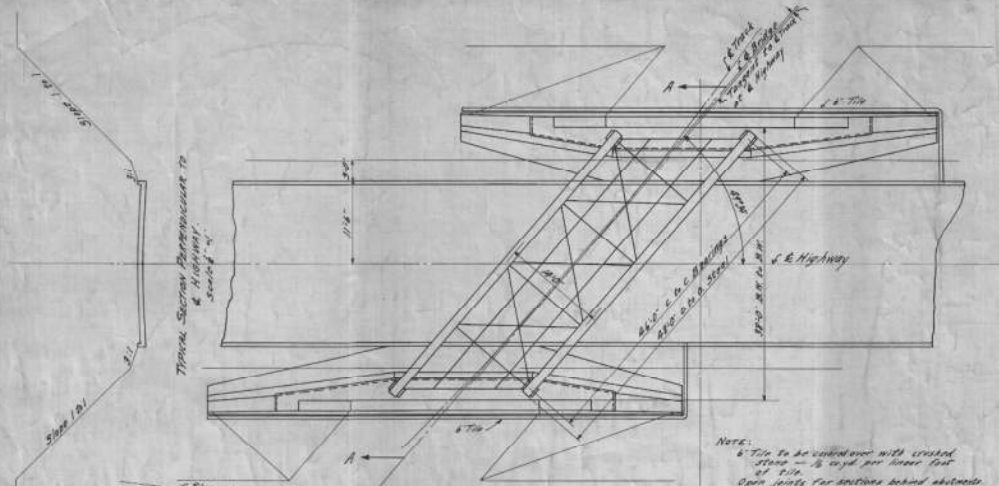
REQUIRED		
2	Floor Beam	FB1
2	" "	FB2
2	" "	FB3
2	Bracket	B1
2	"	B2
2	"	B3[R]
4	"	B3[L]
6	Stringer	S1
2	"	S2
2	"	S3

General Notes

Rivets: 7/8"ø
Open holes 15/16"ø Unless Noted
Paint One Coat of Detroit Graphite Co's #2400 Ready Mixed Red Lead Surfaces in Contact One Coat Each Parts inaccessible after Erection Two Coats.
Reaming: All Holes subpunched 3/4" and reamed to 13/16" - except Holes in pa, pb, hd and Holes A which may be punched 15/16" ø. Holes marked R.T. to be subpunched 1/8" and reamed to 15/16" ø thru a Steel Templet.

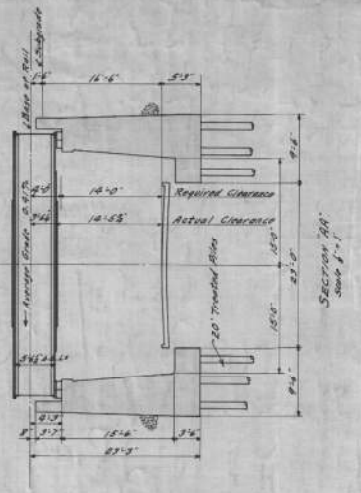
WABASH RY.
Bridge No 708-B Moberly Div.
L- 98 Ft. S.T. Thru Pl. Girder Span
49° 34' Skew
Details of - Fl. Beams + Stringers

AMERICAN BRIDGE COMPANY
DRAWING MADE AT Gary PLANT #3
WORK FABRICATED AT Gary PLANT
IN CHARGE OF Strang
DRAWN MADE BY J.D.G. DATE 6-25-26
DRAWN CHECKED BY W.W.J. DATE 7-15-26
ORDER No. E9164 SHEET NO. 2

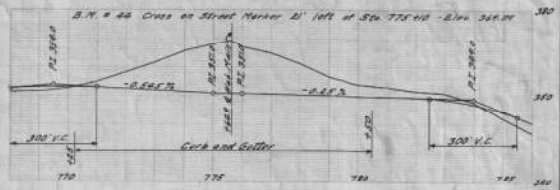


General Plan.
Scale 1/8"=1'

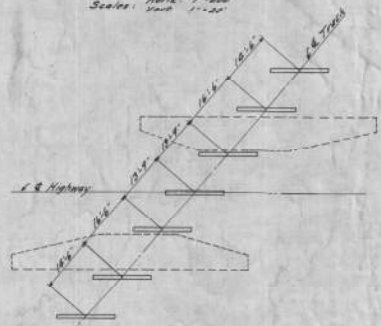
Note:
6" Tile to be covered over with Crushed Stone — 1/2 cu.yd. per linear foot of tile.
Open joints for sections behind abutments
Marker — — perpendicular to Highway.
Flow line to be level with gutter at curb.



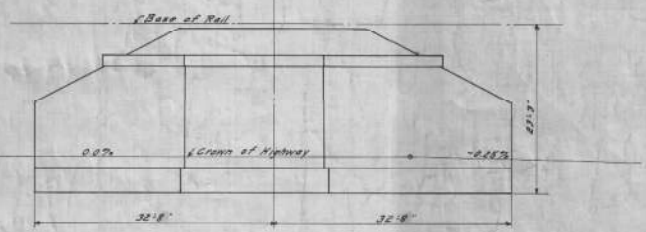
Section "AA"
Scale 1/4"=1'



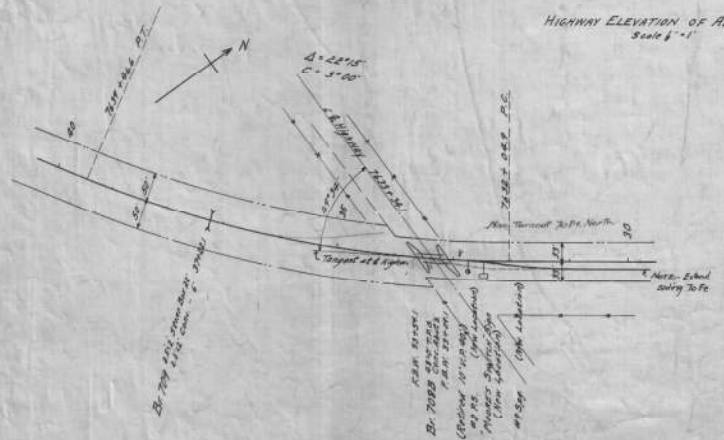
Profile along ℄ Highway
Scales: Horiz. 1"=200'
Vert. 1"=20'

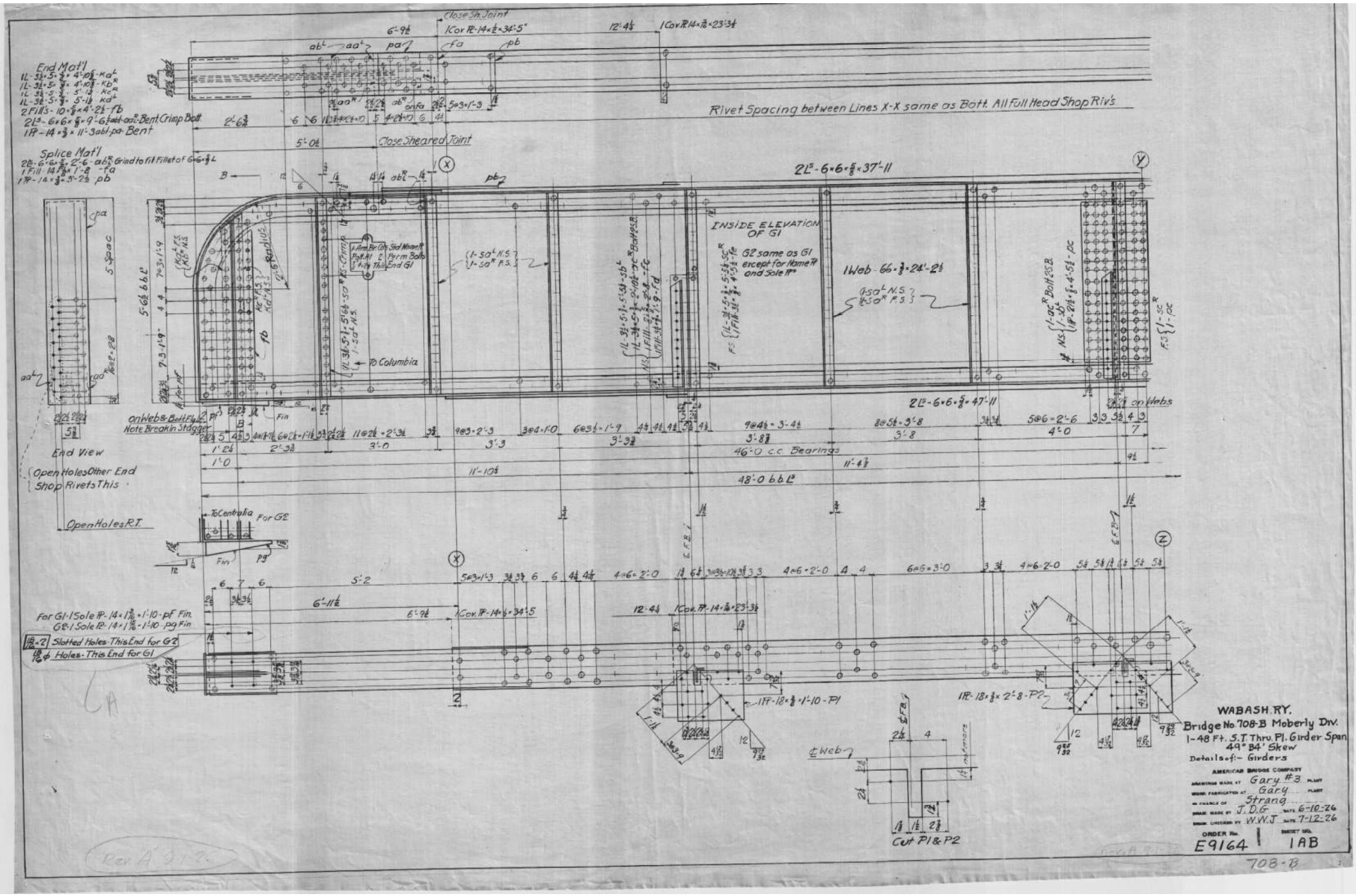


Plan showing location of Bents of Pile Trestle.
Scale 1/8"=1'



Highway Elevation of Abutment
Scale 1/4"=1'

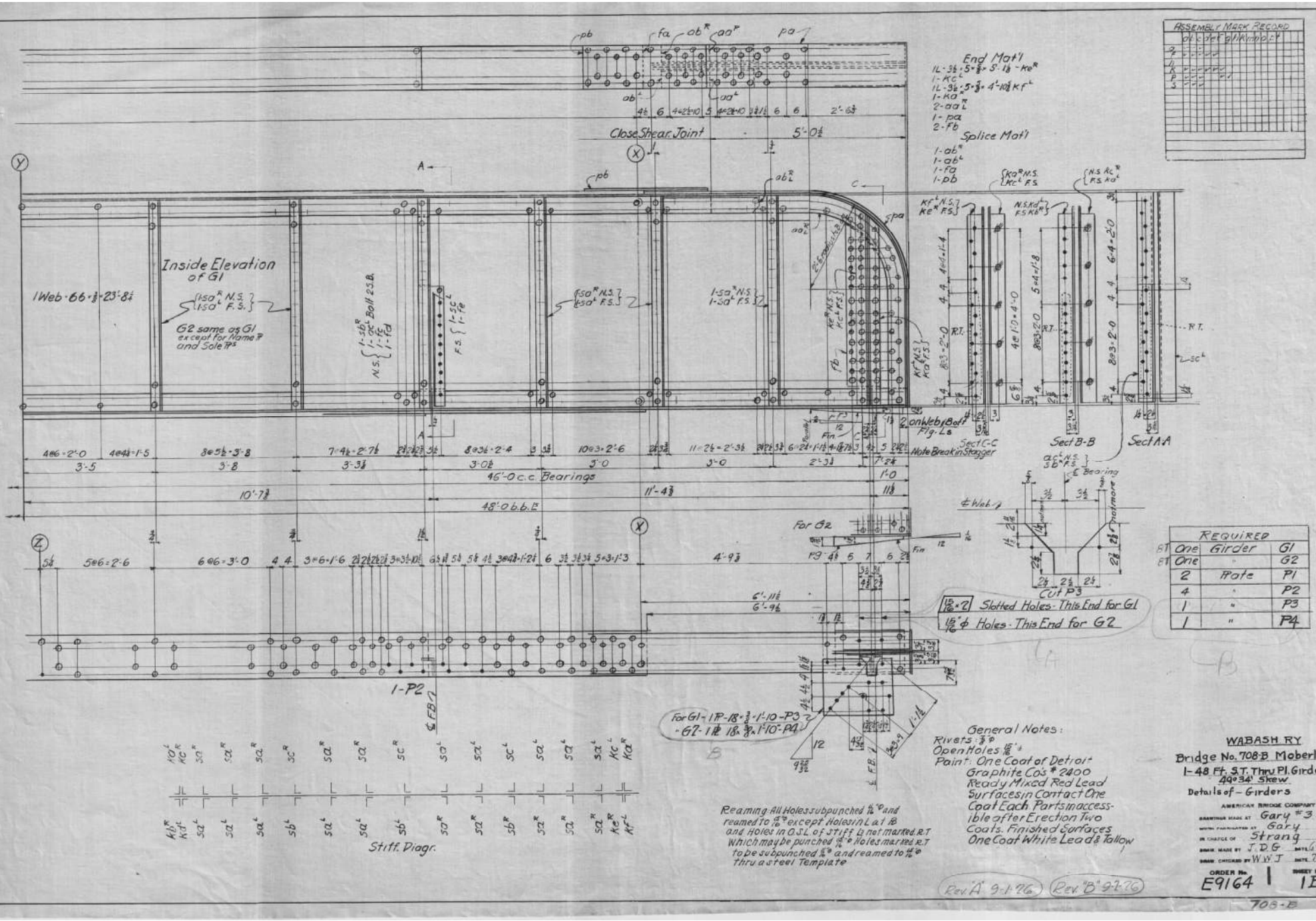

N
Δ = 22°15'
D = 3°00'
℄ Highway
Tangent at ℄ Highway
Tangent at ℄ Track
℄ Track
Tangent at ℄ Track
Bridge 708B
Bridge 708A
Bridge 708C
Bridge 708D
Bridge 708E
Bridge 708F
Bridge 708G
Bridge 708H
Bridge 708I
Bridge 708J
Bridge 708K
Bridge 708L
Bridge 708M
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Bridge 708O
Bridge 708P
Bridge 708Q
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Bridge 708CR
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Bridge 708CT
Bridge 708CU
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Bridge 708CY
Bridge 708CZ
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Bridge 708DN
Bridge 708DO
Bridge 708DP
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Bridge 708DS
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Bridge 708LF
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Bridge 708LQ
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Bridge 708QT
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Bridge 708RN
Bridge 708RO
Bridge 708RP
Bridge 708RQ
Bridge 708RR
Bridge 708RS
Bridge 708RT
Bridge 708RU
Bridge 708RV
Bridge 708RW
Bridge 708RX
Bridge 708RY
Bridge 708RZ
Bridge 708SA
Bridge 708SB
Bridge 708SC
Bridge 708SD
Bridge 708SE
Bridge 708SF
Bridge 708SG
Bridge 708SH
Bridge 708SI
Bridge 708SJ
Bridge 708SK
Bridge 708SL
Bridge 708SM
Bridge 708SN
Bridge 708SO
Bridge 708SP
Bridge 708SQ
Bridge 708SR
Bridge 708SS
Bridge 708ST
Bridge 708SU
Bridge 708SV
Bridge 708SW
Bridge 708SX
Bridge 708SY
Bridge 708SZ
Bridge 708TA
Bridge 708TB
Bridge 708TC
Bridge 708TD
Bridge 708TE
Bridge 708TF
Bridge 708TG
Bridge 708TH
Bridge 708TI
Bridge 708TJ
Bridge 708TK
Bridge 708TL
Bridge 708TM
Bridge 708TN
Bridge 708TO
Bridge 708TP
Bridge 708TQ
Bridge 708TR
Bridge 708TS
Bridge 708TT
Bridge 708TU
Bridge 708TV
Bridge 708TW
Bridge 708TX
Bridge 708TY
Bridge 708TZ
Bridge 708UA
Bridge 708UB
Bridge 708UC
Bridge 708UD
Bridge 708UE
Bridge 708UF
Bridge 708UG
Bridge 708UH
Bridge 708UI
Bridge 708UJ
Bridge 708UK
Bridge 708UL
Bridge 708UM
Bridge 708UN
Bridge 708UO
Bridge 708UP
Bridge 708UQ
Bridge 708UR
Bridge 708US
Bridge 708UT
Bridge 708UU
Bridge 708UV
Bridge 708UW
Bridge 708UX
Bridge 708UY
Bridge 708UZ
Bridge 708VA
Bridge 708VB
Bridge 708VC
Bridge 708VD
Bridge 708VE
Bridge 708VF
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Bridge 708VH
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Bridge 708VS
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Bridge 708WZ
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Bridge 708XB
Bridge 708XC
Bridge 708XD
Bridge 708XE
Bridge 708XF
Bridge 708XG
Bridge 708XH
Bridge 708XI
Bridge 708XJ
Bridge 708XK
Bridge 708XL
Bridge 708XM
Bridge 708XN
Bridge 708XO
Bridge 708XP
Bridge 708XQ
Bridge 708XR
Bridge 708XS
Bridge 708XT
Bridge 708XU
Bridge 708XV
Bridge 708XW
Bridge 708XX
Bridge 708XY
Bridge 708XZ
Bridge 708YA
Bridge 708YB
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Bridge 708YE
Bridge 708YF
Bridge 708YG
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Bridge 708YI
Bridge 708YJ
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Bridge 708YU
Bridge 708YV
Bridge 708YW
Bridge 708YX
Bridge 708YY
Bridge 708YZ
Bridge 708ZA
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Bridge 708ZC
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Bridge 708ZE
Bridge 708ZF
Bridge 708ZG
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Bridge 708ZI
Bridge 708ZJ
Bridge 708ZK
Bridge 708ZL
Bridge 708ZM
Bridge 708ZN
Bridge 708ZO
Bridge 708ZP
Bridge 708ZQ
Bridge 708ZR
Bridge 708ZS
Bridge 708ZT
Bridge 708ZU
Bridge 708ZV
Bridge 708ZW
Bridge 708ZX
Bridge 708ZY
Bridge 708ZZ
Tangent at ℄ Highway
Tangent at ℄ Track
Horiz. Echord spacing To Pc.
Tangent at ℄ Track
Tangent at ℄ Track
Tangent at ℄ Track



WABASH RY.
Bridge No. 708-B Moberly Div.
1-48 Ft. S.T. Thru. Pl. Girder Span
49° 84' Skew
Details of:- Girders

AMERICAN BRIDGE COMPANY
Drawings made at Gary #3 Plant
Work fabricated at Gary Plant
In charge of Strang
Drawn made by J.D.G. Date 6-10-26
Design checked by W.W.J. Date 7-12-26
Order No. E9164 | Sheet No. 1AB

708-B

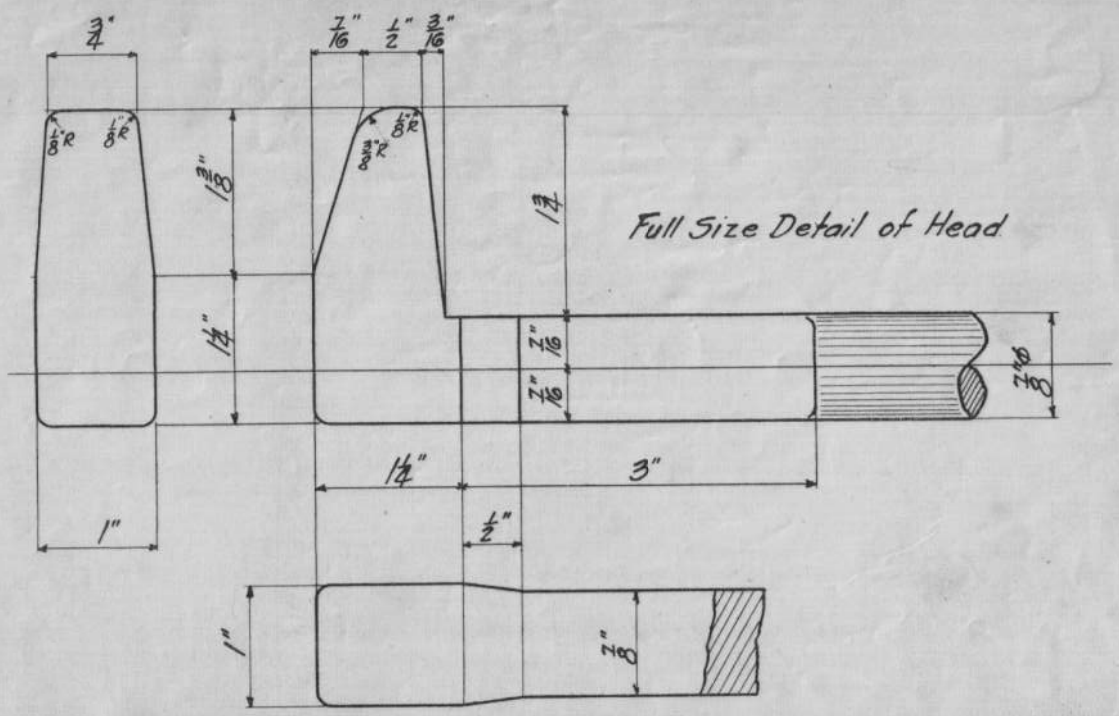


ASSEMBLY MARK RECORD												

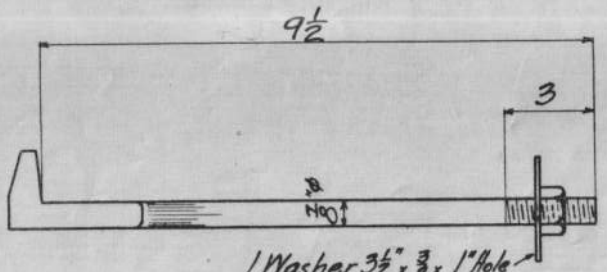
REQUIRED		
1 ST One	Girder	G1
1 ST One	"	G2
2	Plate	P1
4	"	P2
1	"	P3
1	"	P4

SKETCH, SHOP AND SHIPPING BILL

AMERICAN BRIDGE COMPANY



Full Size Detail of Head



1 Washer 3½" x ⅜ x 1" Hole

Hook Bolt ⅞" Ø x

MEMBER NO. PCS.	MEMBER NAME	MEMBER MARK	MATERIAL NO. PCS.	MATERIAL SHAPE	LENGTH FT.	LENGTH INS.	+ INS.	REMARKS	CALCULATED WEIGHT FOR ONE MEMBER	ORDERED NO. PCS.	ORDERED LENGTH FT.	ORDERED LENGTH INS.	ORDERED ITEM	SHIPMENTS
30	Hook Bolts	HB1	30	⅞"Ø 9½"					Total 69	1" Ø			S	
			30	Washers 3½"Ø x ⅜ 1" Hole					27				SS	
			30	Hex Nuts ⅞ Tap					9				SS	
									105					

Rev 8-4-26

Paint – None
TOTAL 105#

RIVETS	HOLES	DATE	NAME	DATE
—	—		BHB	7 22 26
			ARP	7 22 26
			EH	7-30

DATE 7/22/26

DRAWINGS Gary #3

FABRICATION Gary

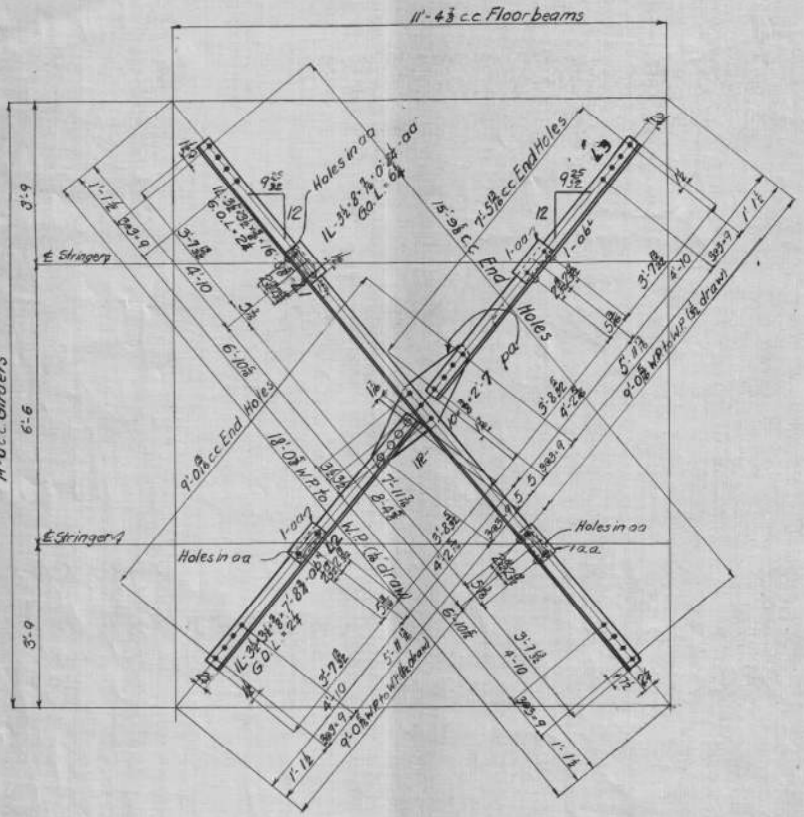
ORDER No. E9164

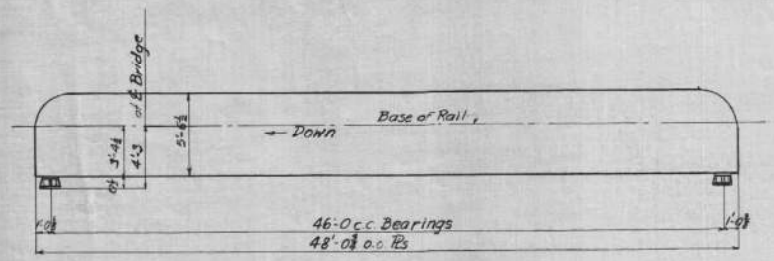
708-B

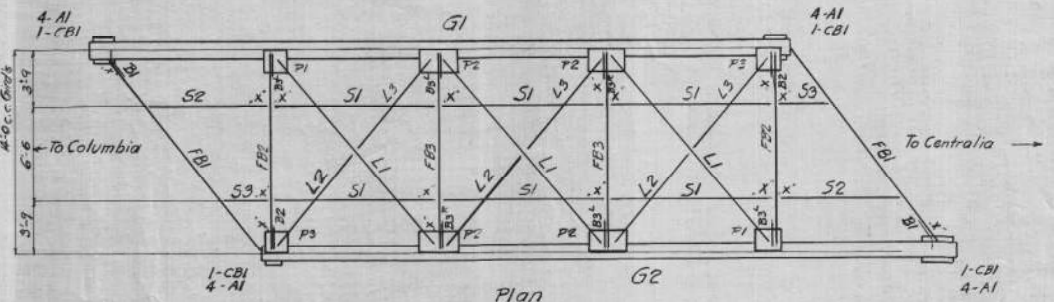
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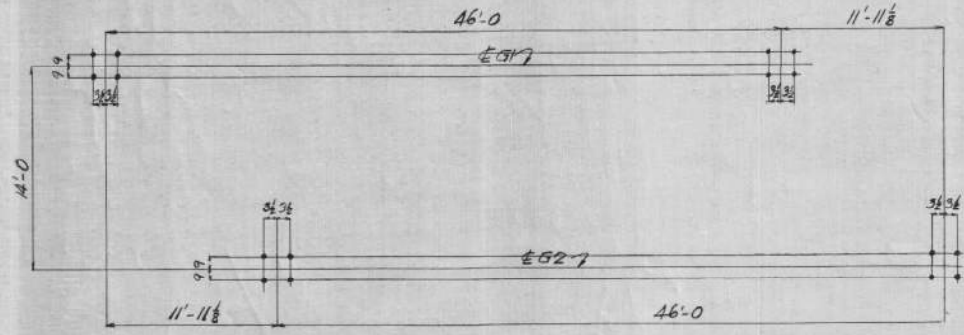
NAME OF STRUCTURE

One 48 Ft. Thru. R. Girder Skew Span. Bridge No# 708-B WABASH RY









Anchor Bolt Plan

REQUIRED		
3	Lateral	L1
3	"	L2
3	"	L3

General Notes:

Rivets: ¾"ϕ
Open Holes: 15/16"ϕ Unless Noted
Paint: One Coat of Detroit Graphite Co's #2400 Ready Mixed Red Lead. Surfaces in Contact One Coat Each. Parts inaccessible after Erection Two Coats.
Rearming: None

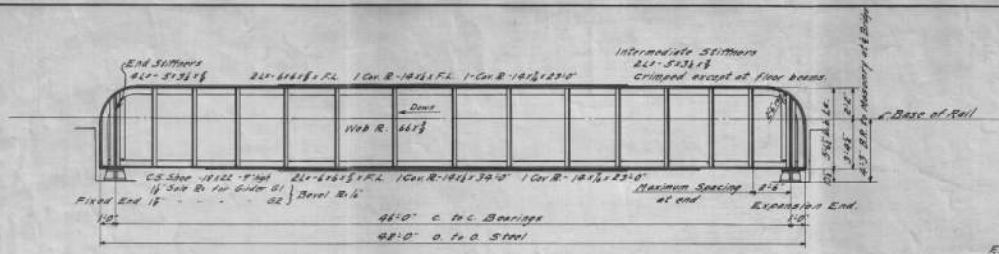
List of Drawings	
1AB	Girders
1-B	Girders
2	Floor Beams & Stringers
3	Laterals & Erection Plan
C1	Cast Pedestals
C2	Anchor Bolts
C3	Field Rivets (summary)
C4	Hook Bolts
EF1	Erectors List of field Rivets

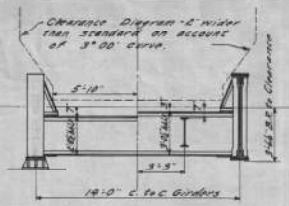
WABASH RY.
Bridge No 708-B Moberly Div
1-48 Ft. S.T. Thru Pl. Girder Span
49°34' Skew
Details of:- Laterals + Erection

AMERICAN BRIDGE COMPANY
DRAWINGS MADE AT Gary #3 PLANT
WORK FABRICATED AT Gary PLANT
IN CHARGE OF Strang
DRAWN BY J.D.G DATE 6-22-26
DRAWN CHECKED BY W.W.J DATE 7-12-26
ORDER No. E9164 | SHEET NO. 3

Matl Ord Pl J.D.G

708-B





BRACKETS:
⅝" Web
2Lx3½"x⅝" Lg
Toe Ls to Stiffner edge of plate.

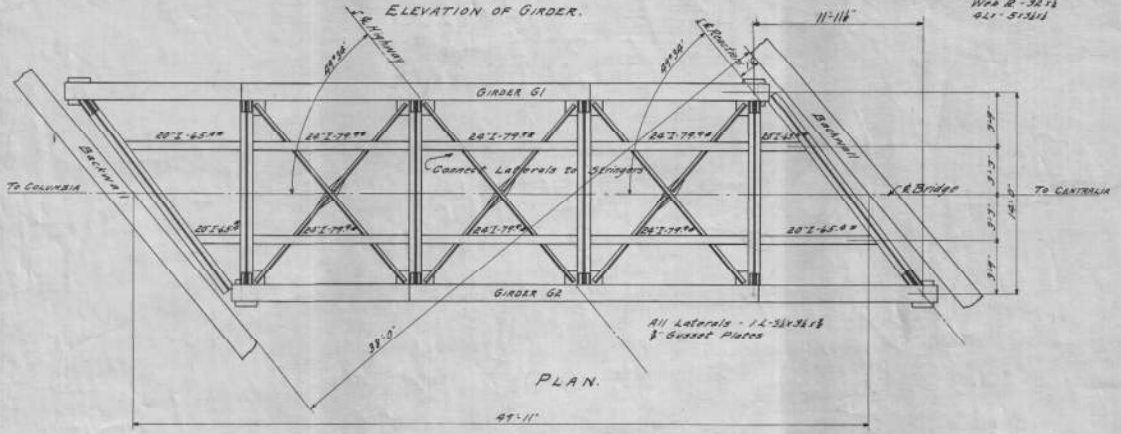
HALF END VIEW

End Floor Beam:
Web R. - 32⅛"
4Lx - 5"x3½"x⅝

HALF SECTION

Intermediate Floor Beam:
Web R. - 36⅛"
4Lx - 5"x3½"x⅝

ELEVATION OF GIRDER.



PLAN.

Estimated Weight of One Girder = 14,100#
Estimated Weight of Span = 32,900#

DESIGN DATA:

48'-0" o. to o. Steel
48'-0" c. to c. Bearings
19'-0" c. to c. Girders
5'-6⅝" ∠ to ∠ Flange Angles

DEAD LOAD:
Track 150
Steel 1250
1400 #/ft. per track
= 700 #/ft. " girder

LIVE LOAD:
Coopers E50.

IMPACT:
A.R.E.A. Specifications - 1920.

MAXIMUM MOMENTS:

Dead Load	=	2,220,000
Live Load	=	12,448,000
Impact	=	11,629,000
Total	=	24,297,000 in.#

MAXIMUM SHEARS:

Dead Load	=	14,100
Live Load	=	103,500
Impact	=	96,700
Total	=	214,300 (Including End Floor Beam reaction)

Web Area Required = 214,300 / 10,000 = 21.43 sq. in.
Web Used: 66⅛" x ⅝" = 26.25 sq. in.

Maximum Flange Area Required = 24,297,000 / 18,000 lbs/sq. in. = 45.32 sq. in.
Flange Used:
2Lx - 6"x6"x⅝" - Area = 14.22
Less Holes 2.50
11.72
⅝" Web 3.09
1 Cov. R. 18"x⅝" Net Area = 6.00
1 " - 18"x⅝" " " = 5.25
Total Net Area = 26.06 sq. in.

Bearing Area Required: 214,300 / 650 = 330 sq. in.
Bearing Area Used: 18"x22" = 396 sq. in.

STRINGERS:
Maximum Section Modulus Required - 1920
Section Modulus Used = 173.9
Web Area Required = 8.72 sq. in.
Web Area Used = 10.8 " "

INTERMEDIATE FLOOR BEAMS:
Maximum Section Modulus Required = 322.3
Section Modulus Used = 320.8
Web Area Required = 11.48 sq. in.
Web Area Used = 19.00 " "

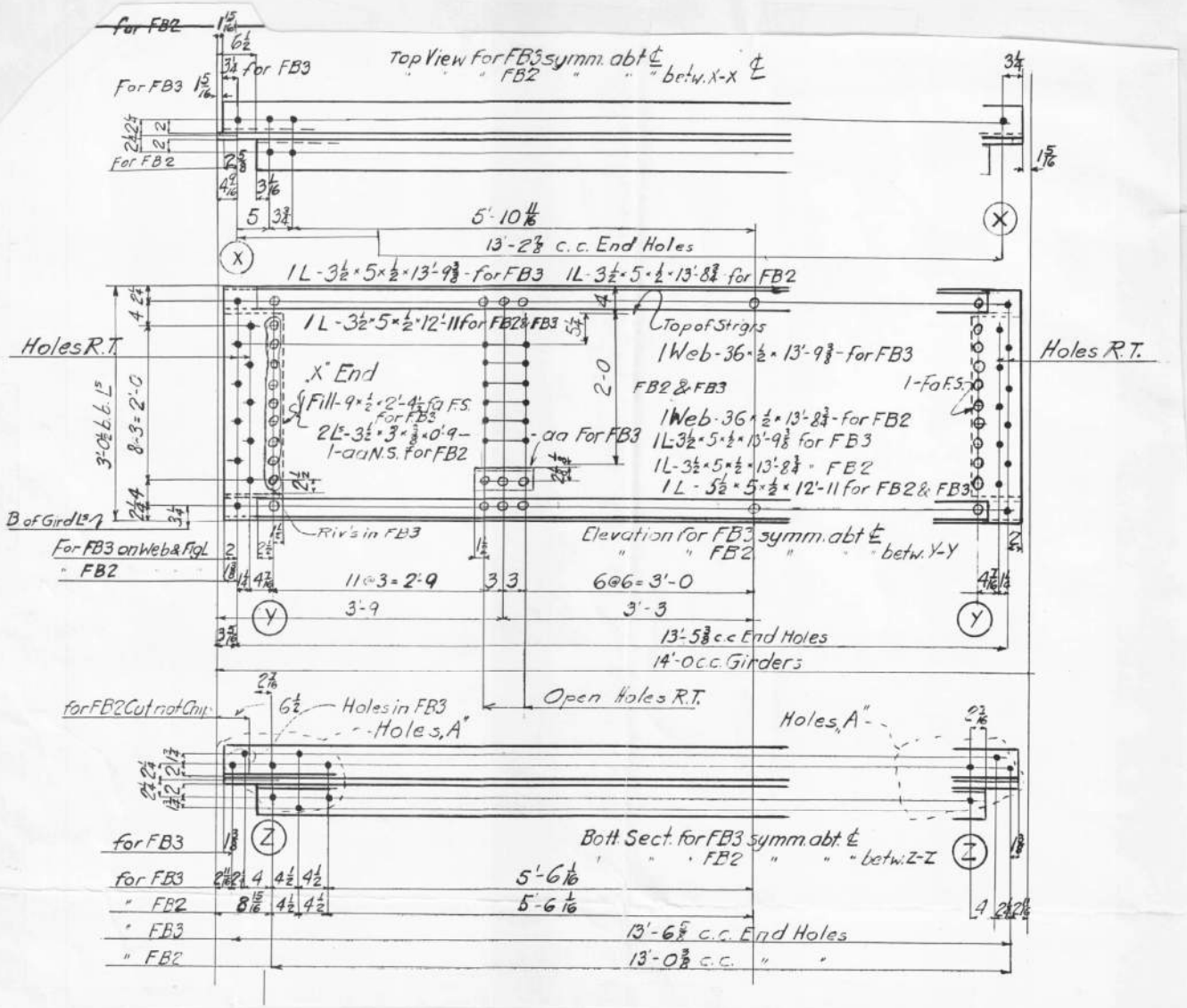
END FLOOR BEAMS:
Maximum Section Modulus Required = 277.6
Section Modulus Used = 276.1
Web Area Required = 6.42 sq. in.
Web Area Used = 16.00 " "

GENERAL NOTES:

SPECIFICATIONS: A.R.E.A. - 1920 - Reamed Work.
ALIGNMENT: 3°00' Curve. Bridge on tangent to curve.
GRADE: Superelevation of rail to be produced by draping ties. Vertical Curve. Steps to be obtained as level, difference in elevations of two ends to be provided in bridge seats.
RIVETS: ⅝" ø
PAINT: One shop coat of Red Lead and oil.

WABASH RAILWAY
MODERLY DIVISION
ONE MILE NORTH OF
COLUMBIA, MO.
BOONE COUNTY
STEEL DESIGN
BRIDGE 708B
OFFICE OF THE CHIEF ENGINEER
SCALE: 1/4"=1' FEBRUARY 18, 1926.
SHEET ③ OF ④

DESIGNED BY W.J.H. DRAWN BY W.J.H. TRACED BY W.J.H. CHECKED BY [illegible]



Notes:

1. Floor beam requiring repair is a "FB3".

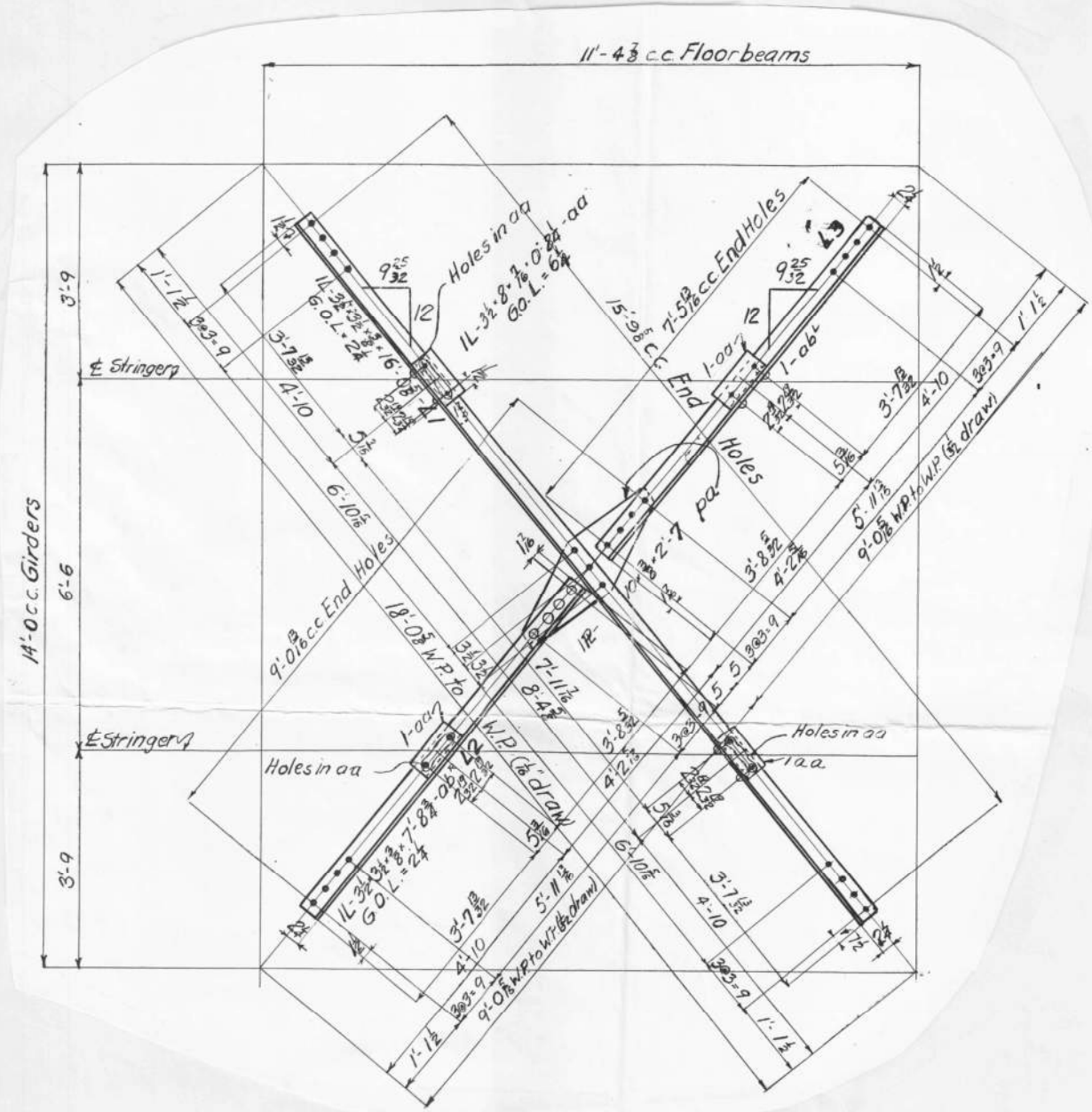
General Notes:

Rivets: 7/8" diameter

Open Holes: 13/16" diameter unless noted

SCALE 3/4" = 1'	DATE	TITLE
DRAWN CJ	7-1-98	**Bridge 708B**
ENGINEER		**Steel Repairs**
CHECKED		**Floor Beam Details**
APPROVED		
FOREMAN		
REVISED		
WATER AND LIGHT DEPARTMENT COLUMBIA, MISSOURI	FILE NO. CIP-10	SHEET 1 OF 2
	MAP REF.	ISSUE

BRUNING 40-5020 70882



Notes:

1. Parts to be replaced are noted as "L3" and "aa".

General Notes:

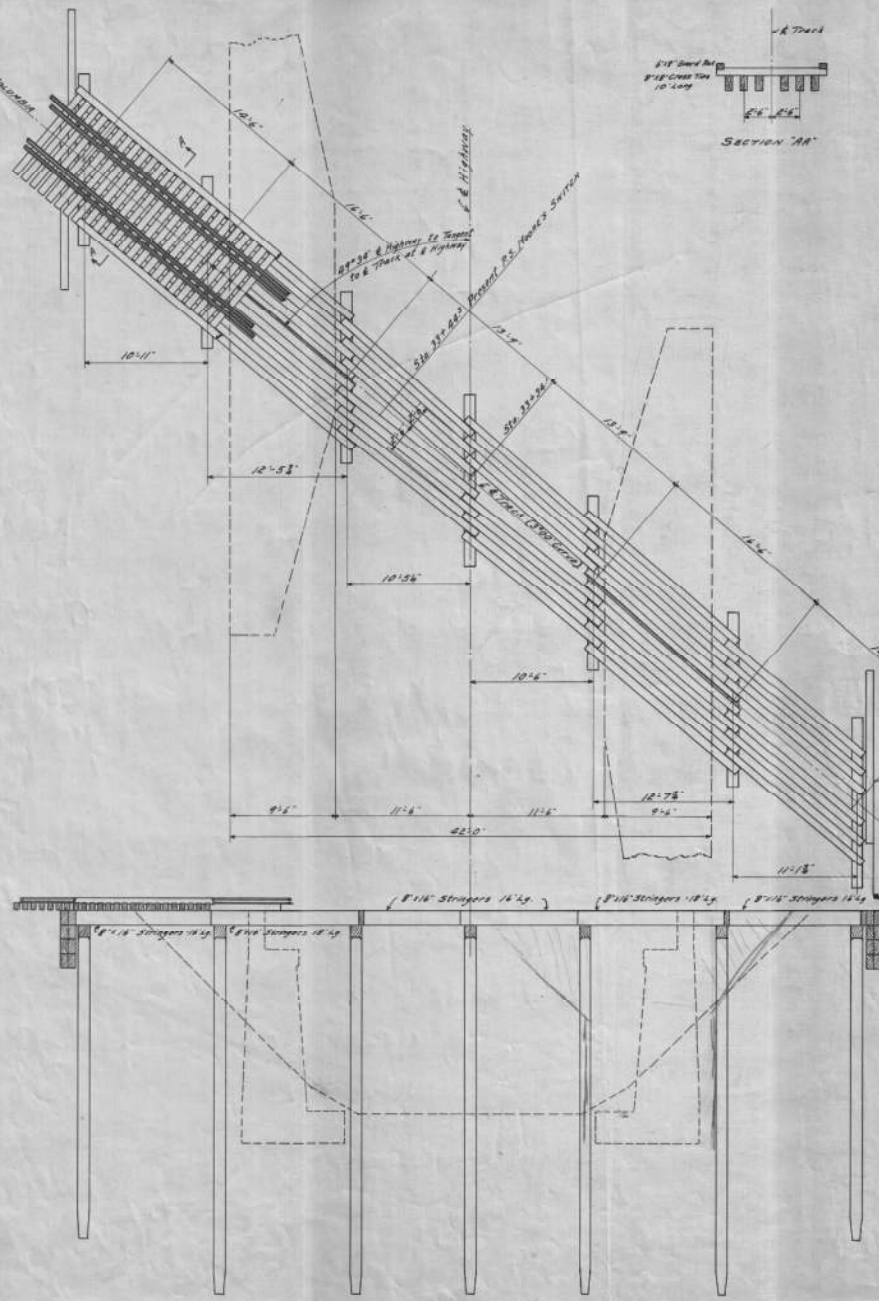
Rivets: 7/8" diameter

Open Holes: 15/16" diameter unless noted

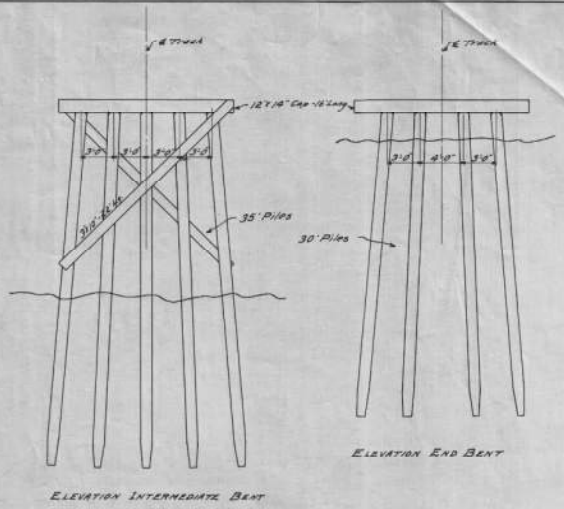
Reaming: None

SCALE 3/4" = 1'	DATE	TITLE	
DRAWN CJ	7-1-98	Bridge 708B	
ENGINEER		Steel Repairs	
CHECKED		Lateral Details	
APPROVED			
FOREMAN			
REVISED			
WATER AND LIGHT DEPARTMENT COLUMBIA, MISSOURI		FILE NO. C1P-10	SHEET 2 OF 2
		MAP REF.	ISSUE

BRUNING 40-5023 70882



SECTION "AA"



ELEVATION INTERMEDIATE BENT

ELEVATION END BENT

NOTE:
Piles in each bent to be driven symmetrically about ℄ Track.

BILL OF MATERIAL.

No.	Size	Length	Remarks
8		30'	Piles
25		35'	"
7	12"x16"	16'-0"	Caps
10	3"x10"	28'-0"	Bracos
14	8"x8"	18'0"	Bulkheads - S.H.
28	8"x16"	16'-0"	Stringers
14	8"x16"	18'-0"	"
95	8"x8"	10'-0"	Cross Ties
13	4"x8"	16'-0"	Guard Rail
19	¾"ø	3'-0"	Chord Bolts
10	¾"ø	2'-3"	"
62	¾"ø	18"	Lag Screws - Guard Rail to Ties
30	¾"ø	16"	Drift Bolts - Ties to Stringers
65	¾"ø	22"	" - Stringers to Caps & to Piles
30	¾"ø	11"	Bolts - Bracing to Piles
5	¾"ø	20"	"
85	½"ø		Cut Washers - Lag Screws.
168	½"ø		Malleable Washers

WABASH RAILWAY
MORERLY DIVISION
ONE MILE NORTH OF
COLUMBIA, MO.
BOONE COUNTY
TEMPORARY TRESTLE
BRIDGE 708B
OFFICE OF THE CHIEF ENGINEER
SCALE: 3/16=1'
JANUARY 28.1926.
SHEET (4) OF (4)

DRAWN BY W.H.H. TRACED BY W.L.H. CHECKED BY

APPENDIX B

INSPECTION FIELD NOTES

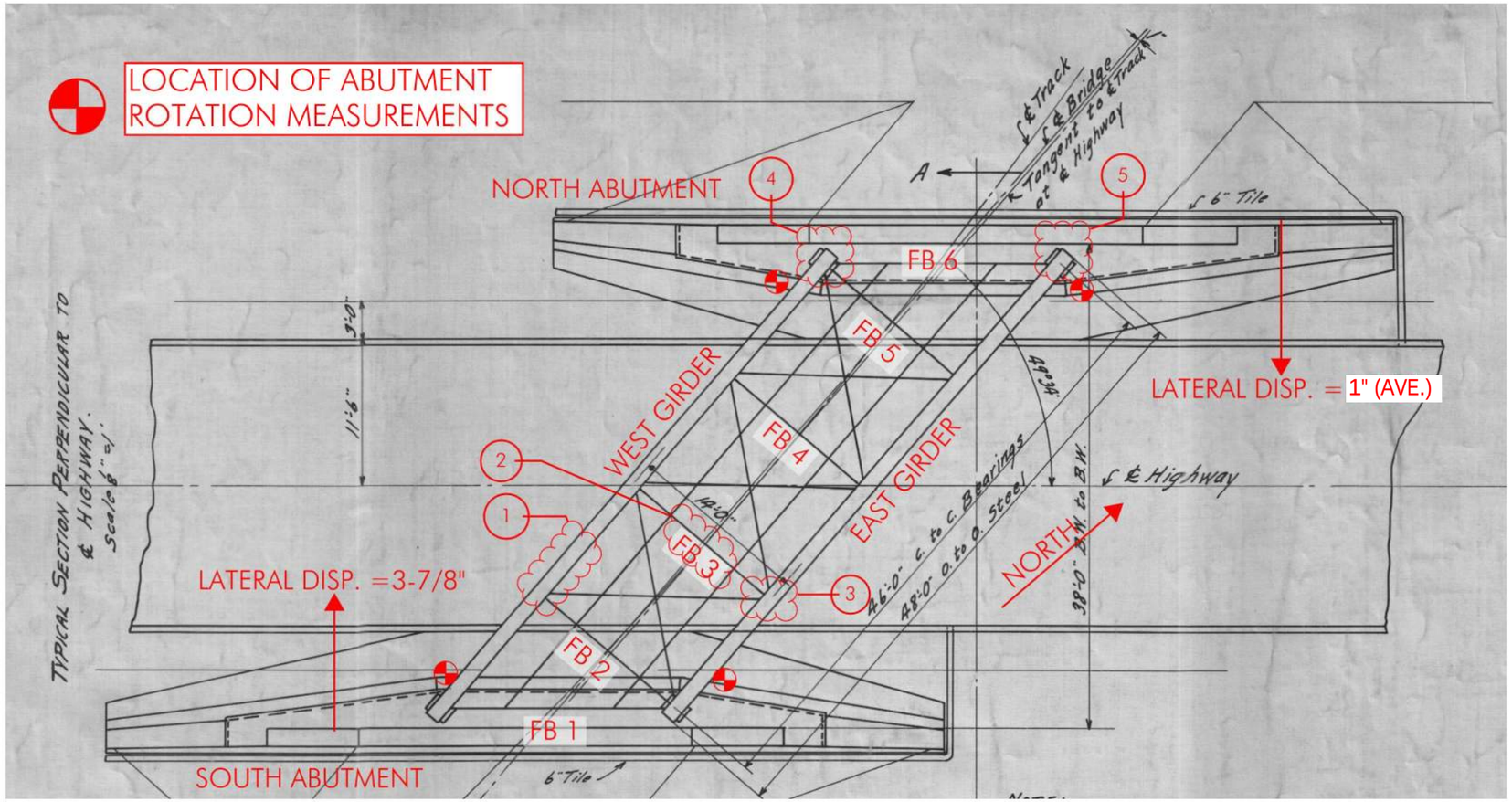
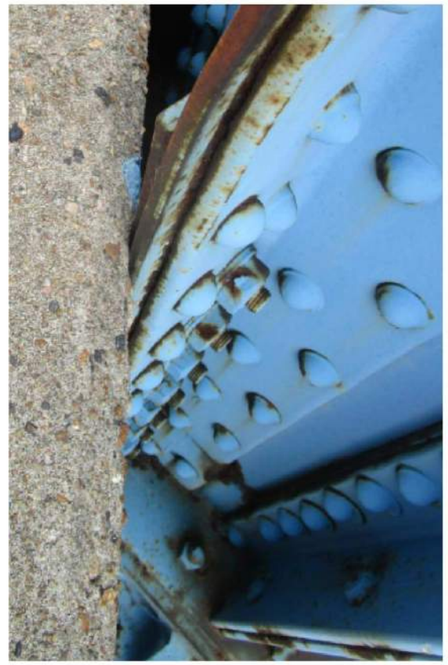


Photo of Defect 4



SUPERSTRUCTURE INSPECTION NOTES

1. IMPACT DAMAGE TO BOTTOM FLANGE OF WEST GIRDER. DAMAGE APPROX. 3FT FROM FB 2 AND 3FT LONG WITH 2-1/2" VERTICAL DEFLECTION.
2. IMPACT DAMAGE TO BOTTOM FLANGE OF FB 3. DAMAGE APPROX. 2FT LONG WITH 3-3/4" VERTICAL DEFLECTION NEAR MIDSPAN OF FB3.
3. RIVIT MISSING FROM BOTTOM FLANGE OF EAST GIRDER NEAR FB3. NOTE SEVERAL BOLTS REPLACED AT THIS LOCATION.
4. BRIDGE IN CONTACT WITH ABUTMENT. BEARING ANCHORS COMPROMISED.
5. BRIDGE NEARLY IN CONTACT WITH ABUTMENT. BEARING ANCHORS COMPROMISED.

Photo of Defect 1



Photo of Defect 2



Photo of Defect 3



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building strong communities.
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F 573-814-1128
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Expires: December 31, 2018

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DATE 11/1/2018

DANE M. SHAW
NO. 2017019045
MY LICENSE RENEWAL DATE IS DECEMBER 31, 2019

STATE OF MISSOURI · DANE M SHAW · NUMBER PE-2017019045 · PROFESSIONAL ENGINEER

11.19.2018

CITY OF COLUMBIA, MO
COLT BRIDGE 708B

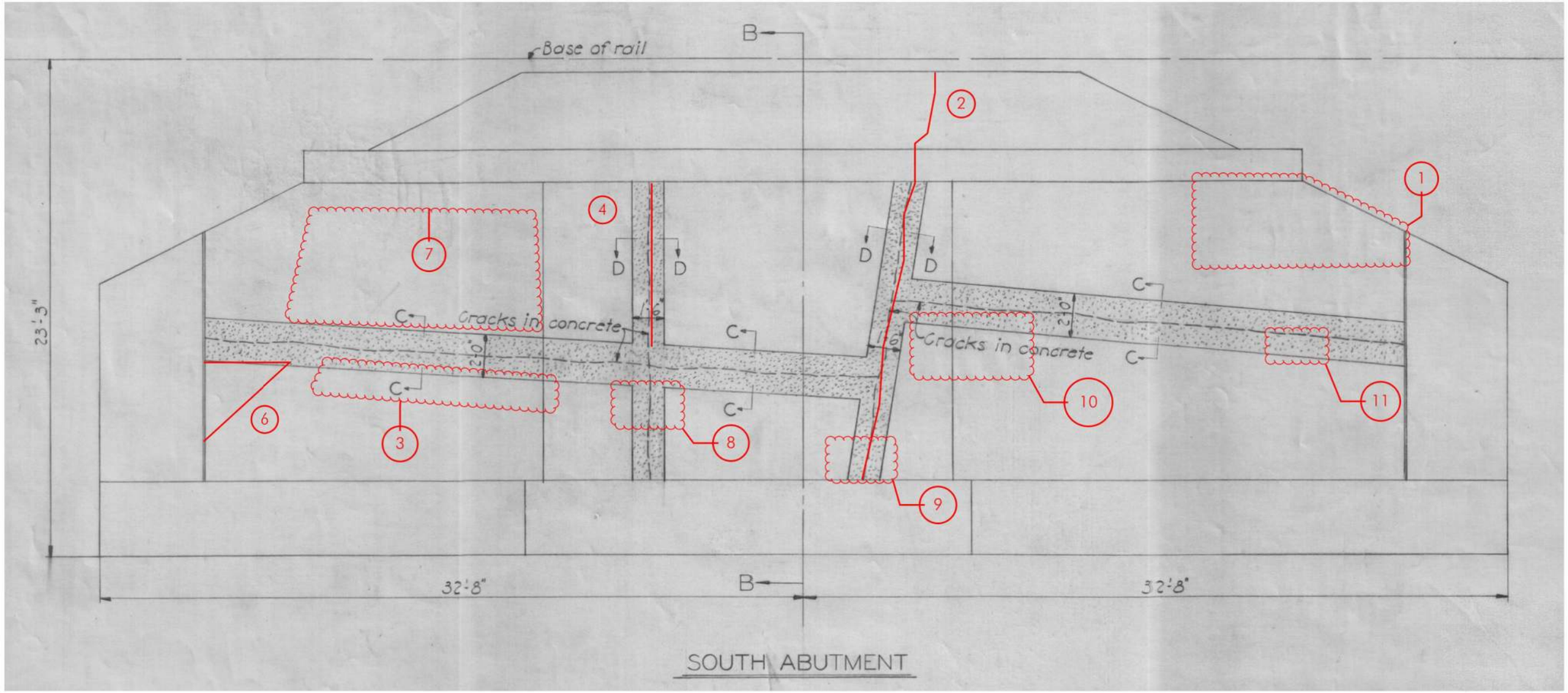
COLUMBIA, MO
81518001-00
11.1.2018

REVISIONS
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ENGINEER DMS
DRAWN BY DMS
CHECKED BY
FIELD BOOK NO. FIELDBOOK

SUPERSTRUCTURE NOTES

DRAWING NO. S101
SHEET NO. 1 08



SOUTH ABUTMENT INSPECTION NOTES

1. Wing is displaced 3" outward. Appears similar to 2013 inspection report findings.
2. Wide crack full height w/ eff. at lower portion. Crack extends through cap and backwall.
3. Large spall with heavy eff. approx. 10ft x 2ft x 10" deep
4. Wide cracks (1/4" wide) with eff. along middle of repair material.
5. General cracking at repair material periphery, typical of abutment.
6. Large delamination 4ft x 4ft
7. Large Area of map cracking with eff. approx. 10ft x 15ft with most of the area delaminated.
8. Delamination approx. 2ft x 2ft extending from the base of the defect 4 crack.
9. Delamination approx. 2ft x 3ft extending from the roadway.
10. Delamination approx. 5ft x 4ft approx. 20 ft from SW end of wall
11. Outward displacement noted in defect 1 with heavy water penetration and staining.

Photo of Defect 2



Photo of Defect 11



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DATE

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NO. 2017019045
MY LICENSE RENEWAL DATE IS DECEMBER 31, 2019

STATE OF MISSOURI
DANE M SHAW
NUMBER PE-2017019045
PROFESSIONAL ENGINEER

11.19.2018

CITY OF COLUMBIA, MO
COLT BRIDGE 708B

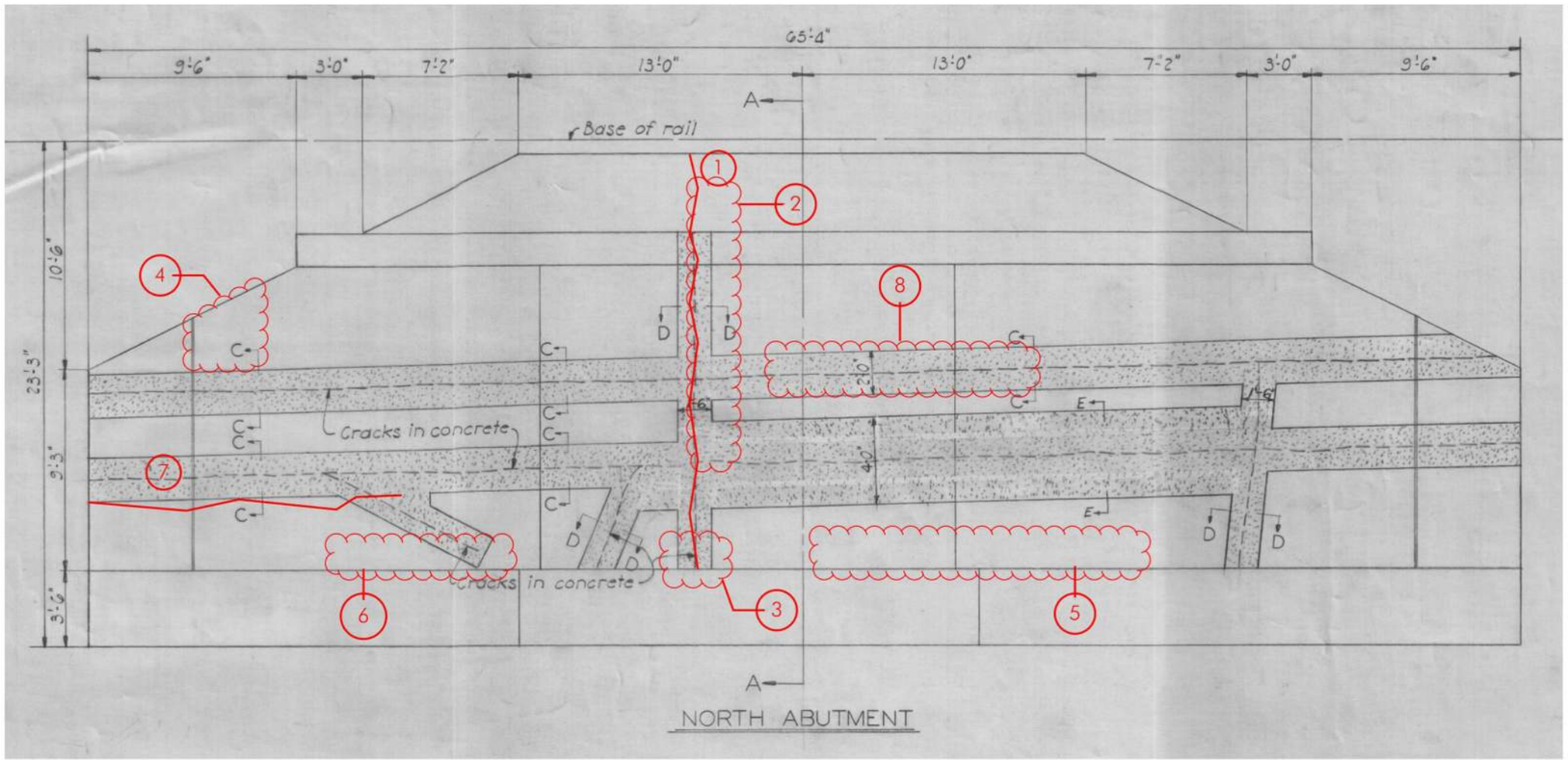
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FIELD BOOK NO. FIELDBOOK

SOUTH ABUTMENT

DRAWING NO. S102
SHEET NO. 1 08



NORTH ABUTMENT INSPECTION NOTES

1. Wide crack full height of backwall. 1" wide at top of abutment and thru backwall
2. Delamination near full height along defect 1 approximately 2ft wide. Likely repair material.
3. Large spall w/ exposed reinforcing. Approx. 2ft x 2ft x 8in. deep.
4. Large delamination 2ft x 3ft at wing interface.
5. Delamination along bottom of horizontal repair approx. 2ft x 15ft
6. Delamination of repair material approx. 9ft x 2ft
7. Crack along bottom of repair with efflorescence approx. 10ft.
8. Map cracking and efflorescence of repair material approx. 10ft x 3ft

GENERAL NOTES:

In general cracking and efflorescence follows the edges and extents of repair materials. Larger cracks appear located near repairs if not centered within repairs. Likely reappearance of cracks repaired in 1944.

Abutment rotation documented on final page of field notes.

Photo of Defect 1



Photo of Defect 3



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DANE M SHAW
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11.19.2018

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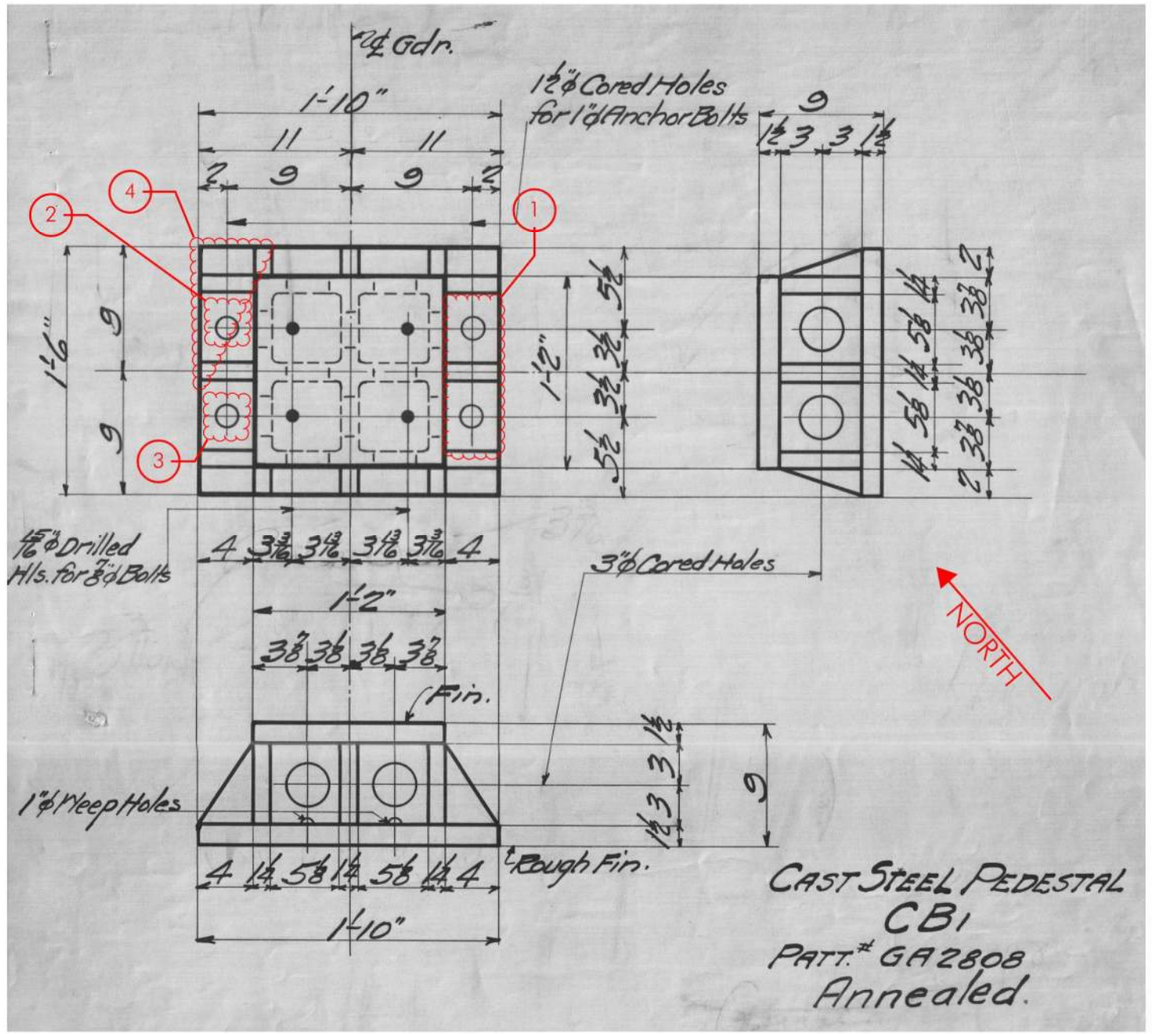
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FIELD BOOK NO. FIELDBOOK

NORTH ABUTMENT

DRAWING NO. S103
SHEET NO. 3 08



SOUTHWEST BEARING NOTES

1. Interior (east) anchor bolts missing heads with significant section loss and corrosion

2. Northwest anchor bolt appears to have limited embedment. 12 inch embedment is design. Anchor bolt appears 3 inches proud of bearing plate. Note the anchor bolt appears vertical with approx. 20% section loss.

3. Southwest anchor bolt appears functional with minor to moderate section loss.

4. Deteriorated concrete with loss of bearing approx. 2 inches wide and 8 inches along the west edge of SW bearing.

5. Deteriorated concrete from bearing continues down the front face of cap with map cracking and spalling concrete. Approximate area is 2ft x 1ft

GENERAL NOTES:

Anchor bolts, while damaged, appear marginally functional and repair of the bolts should be considered.

Photo of Defect 1



Photo of Defects 2 thru 4



Photo of Defect 5



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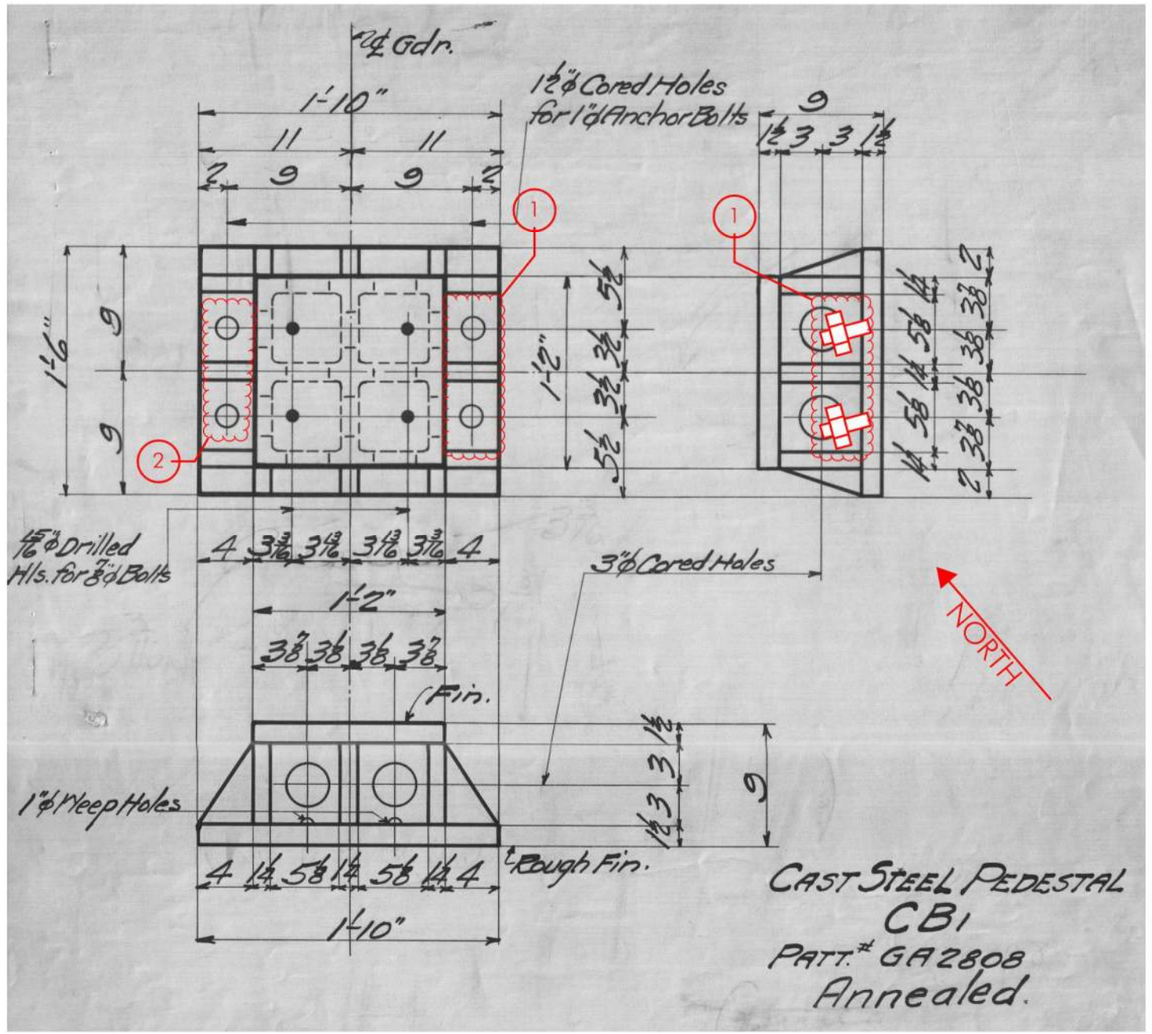
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FIELD BOOK NO. FIELD NOTES

SOUTHWEST BRG NOTES

DRAWING NO. S104
SHEET NO. 4 8



SOUTHEAST BEARING NOTES

1. Exterior (east) anchor bolts are installed however rotation of the bolts indicates shifting of the bearing toward the backwall

2. Interior (west) anchor bolts are in place however rotation is similar to the exterior anchor bolts and severe rust is present.

GENERAL NOTES:

Anchor bolts, while damaged, appear marginally functional and repair of the bolts should be considered. Bolts should be monitored to ensure additional rotation or failure from shear does not occur.

Photo of Defect 1



Photo of Defect 2



Photo of Defect 2



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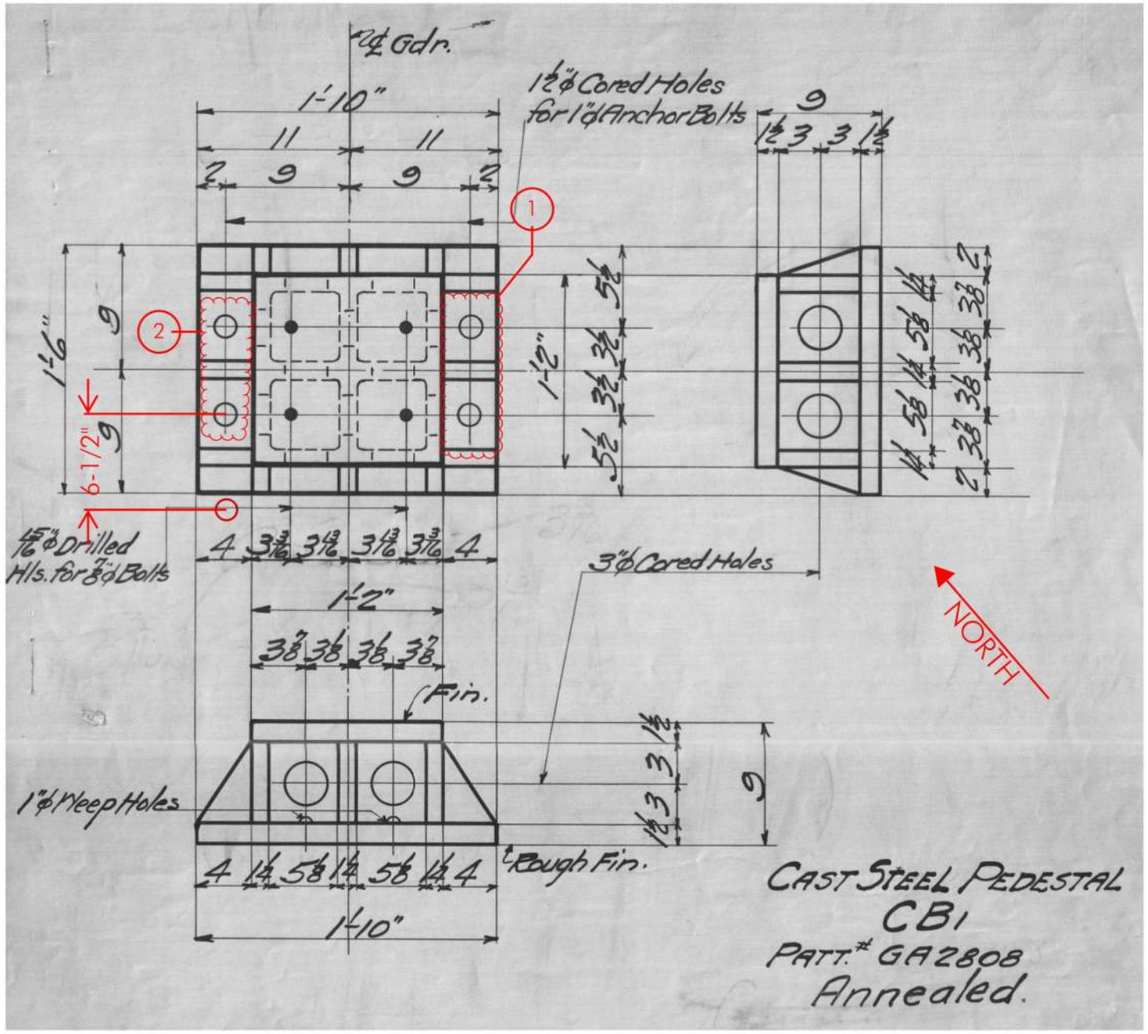
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SOUTHEAST BRG. NOTES

DRAWING NO. S105
SHEET NO. 5 8



NORTHWEST BEARING NOTES

1. Interior (east) anchor bolts are missing with bearing shifted to the north.
2. Exterior (west) anchor bolts are missing with bearing shifted 6.5" to north.

GENERAL NOTES:

Bearing is shifted approx. 6-1/2" from original position. Anchor wells are visible as shown in photo below.

Bearing shift has also resulted in the west girder being fully in contact with the backwall of the north abutment.

GENERAL

NORTH ABUT BACKWALL



Photo of Defect 1



Photo of Defect 2



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NORTHWEST BRG. NOTES

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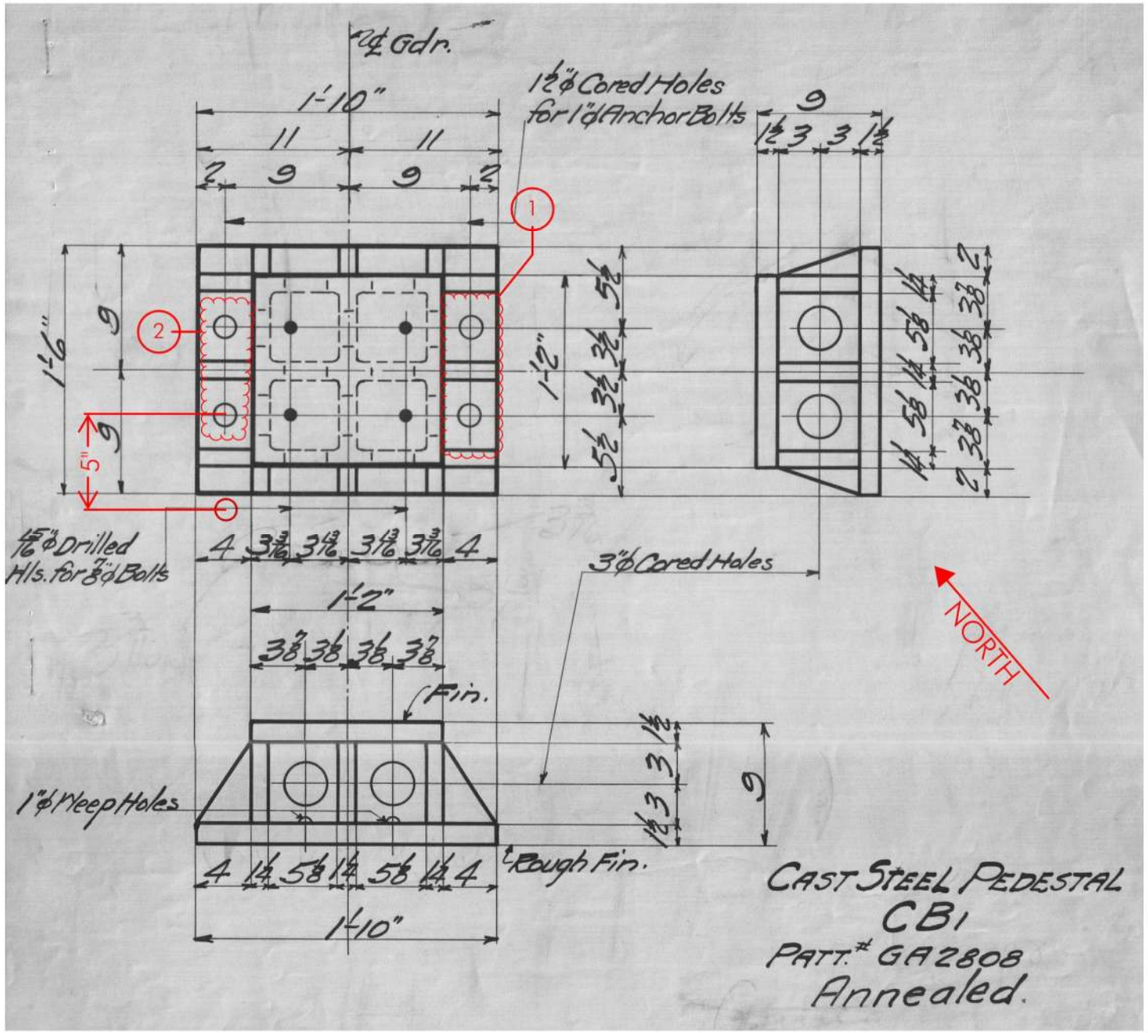


Photo of Defect 1



NORTHEAST BEARING NOTES

1. Exterior (east) anchor bolts are missing with bearing shifted to the north approx. 5"
2. Interior (west) anchor bolts are missing with bearing shifted 5" to north.

GENERAL NOTES:

Bearing is shifted approx. 5" from original position. Anchor wells are visible as shown in photo below for defect 1.

Holes in bearings for anchors appear to have paint within. This suggests that this condition has existed for some time, possibly since 1999 when repainting was done on this structure.

Bearing shift has also resulted in the east girder being nearly (1/2" gap) in contact with the backwall of the north abutment.

GENERAL



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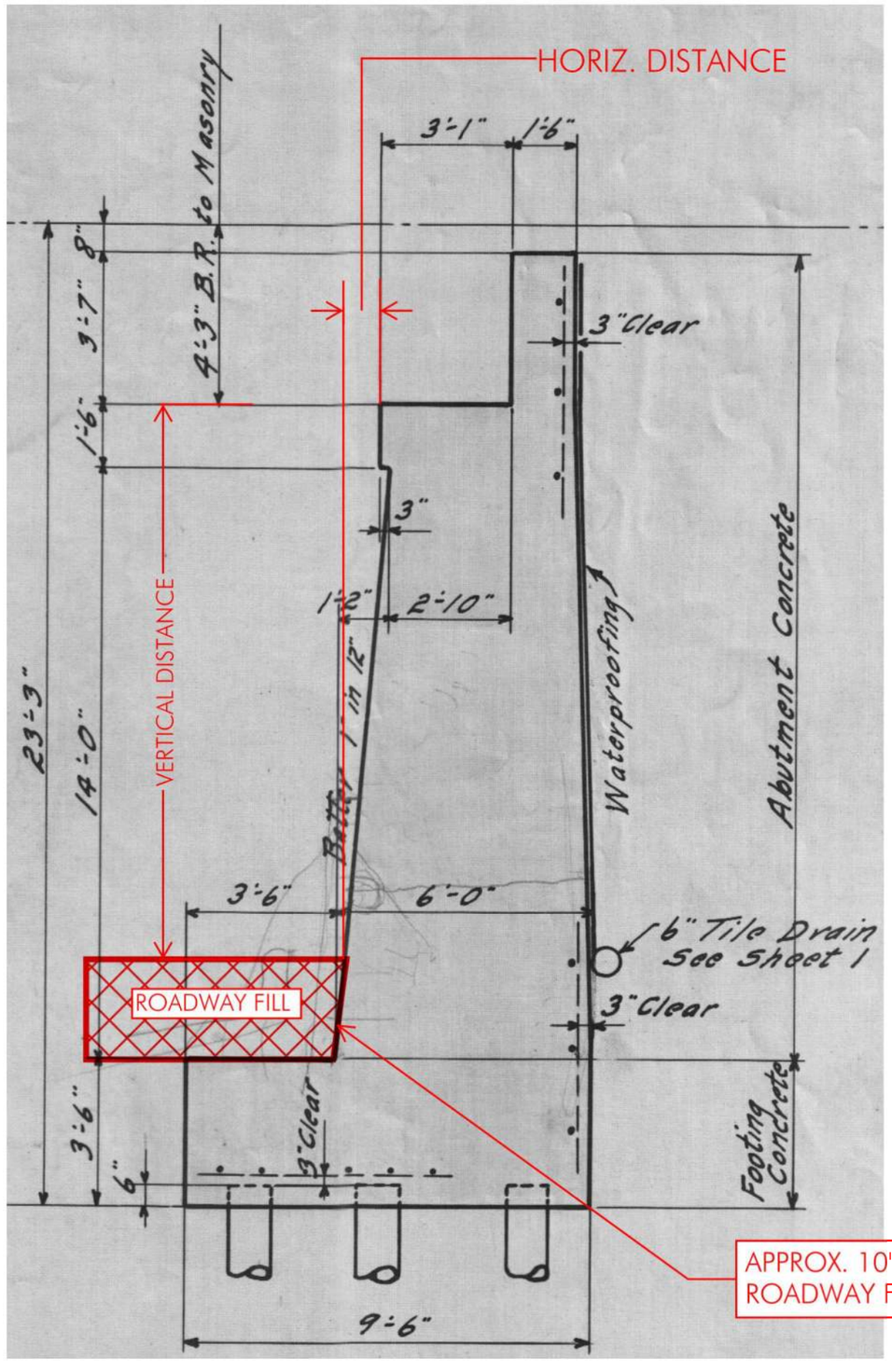
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NORTHEAST BRG. NOTES

DRAWING NO. S107
SHEET NO. 7 8



FIELD MEASUREMENTS

GIRDER/BRG	VERT. DISTANCE	HORIZ. DISTANCE
E/NE	14'-8"	9"
W/NW	14'-8"	9-1/4"
E/SE	14'-8"	6-1/4"
W/SW	14'-8"	6-1/4"

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ABUTMENT ROTATION DIMS

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